AR20

USER Manual

Thank you for selecting a Fisher Scientific accumet pH meter. This manual describes the operation of the accumet AR20 meter. The state-of-the-art meter that you have purchased is easy to operate and will guide you through the various functions by displaying easy to understand prompts. This operating manual should answer any questions that might arise in operating your meter; however, do not hesitate to call our Fisher Lab Equipment Technical Support Hotline at 1-800/943-2006 or 412/490-6260, if you need any assistance.

This meter is designed to provide all the information necessary to guide you through the process of measuring pH, mV, or conductivity with a series of prompts on the screen.

The accumet Research AR20 provides microprocessor precision in a compact benchtop design that is easy to use. One touch screen controls all procedures, letting you:

- Measure pH, absolute mV, relative mV, or conductivity.
- Select one of three sets of standard buffer groups.
- Implement automatic buffer recognition.
- Standardize with up to five standard or custom buffers.
- Customize your display screen and operating parameters.
- Assign operator and sample identification numbers.
- Store 250 data points in the meter's memory or transfer data to a computer or printer.
- Access extensive online help with just a touch of a button.

It all adds up to rapid, completely automatic, intuitive operation.

The following is a listing of what you should have received with your new accumet AR20 pH/mV/Conductivity meter.

Meter with kit includes

meter
power supply
electrode arm support bracket
electrode arm
electrode (13-620-285)
ATC probe (13-620-19)
manual and literature
* Note that this meter does not include a conductivity cell.

Meter only includes

meter
power supply
electrode arm support bracket
manual and literature

If any of these items are missing, please contact the Fisher Products Group Electrochemistry Operation by dialing 412/490-6267.

Accessory Conductivity Probes are available and can be ordered by calling Fisher Customer Service at 800/766-7000.

2-cell Conductivity Probes:

Cell Constant	Optimal Conductivity Range	Glass Body	Epoxy Body
0.1	0.5 to 200 µS/cm	13-620-156	13-620-161
1.0	0.01 to 2 mS/cm	13-620-155	13-620-160
10.0	1 to 200 mS/cm	13-620-157	13-620-162

4-cell Conductivity Probes:

Cell Constant	Optimal Conductivity Range	Glass Body	Epoxy Body
1.0	0.01 to 20 µS/cm	13-620-163	13-620-165
10.0	1 to 200 mS/cm	13-620-164	13-620-166

Display

	640x480 digit LCD
screen size	4 1/2" x 6"
measurement display height	3/4"
temp/etc. display height	1/4"
menu options	extensive
help screens	extensive
configurable display	yes
keypad controls	context specific touchscreen

Memory

	250 data pts
internal diagnostics	yes
programmable data storage	store on stable, time, manual
programmable data output	output on stable, time, manual
print interval	1 to 9,999 sec
programmable alarm	yes

pH Mode

range	-2.000 to 20.000
resolution	0.1/0.01/0.001
relative accuracy	± 0.002
automatic buffer recognition	yes
manual buffer recognition	yes
calibration points	5
auto lock	yes
FET	yes

mV Mode

range	± 1800.0
resolution	0.1
accuracy	± 0.1

Conductivity Mode

cell constants range	0.1, 1.0, 10
conductivity	0 to $3x10^5$ µS/cm
resistivity	30 ohm·cm to 100 megohm·cm
salinity	2 to 42 ppt
accuracy	0.5%

Temperature Mode

range	-5.0 to +105.0 °C
resolution	0.1 °C
accuracy	± 0.2 °C

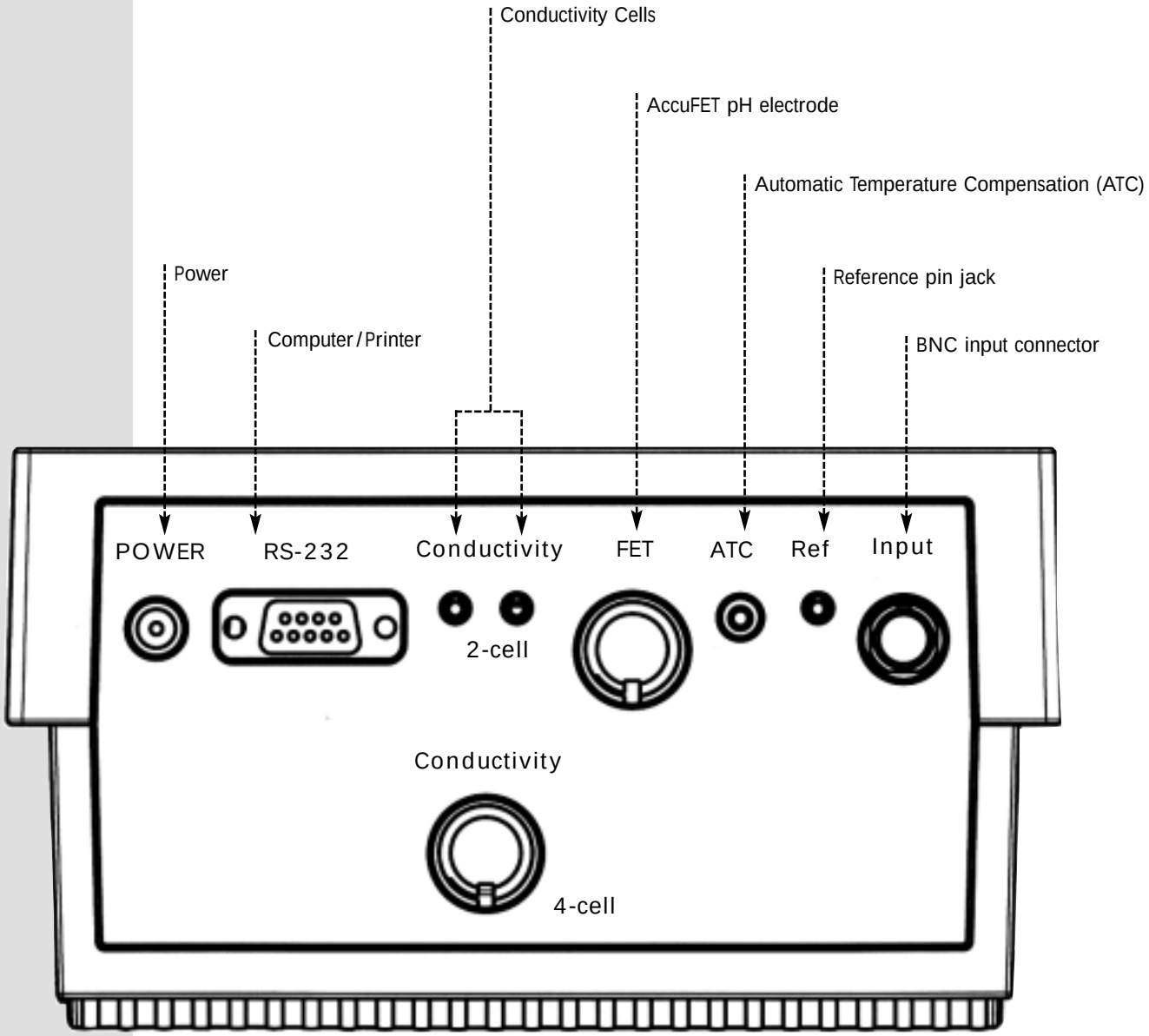
General

inputs/outputs	BNC, Pin, ATC, 2-pin cond. RS232, DIN (for FET and 4 cell cond.)
electrical requirements	115 V/60 Hz, 230 V/50 Hz
output from PSU	12VDC, 500mA
line voltage tolerance	± 10%
input impedance	$>10^{12}$ ohms
meter size	5.5" x 7.5" x 3.25"
meter weight	1.86 lb.

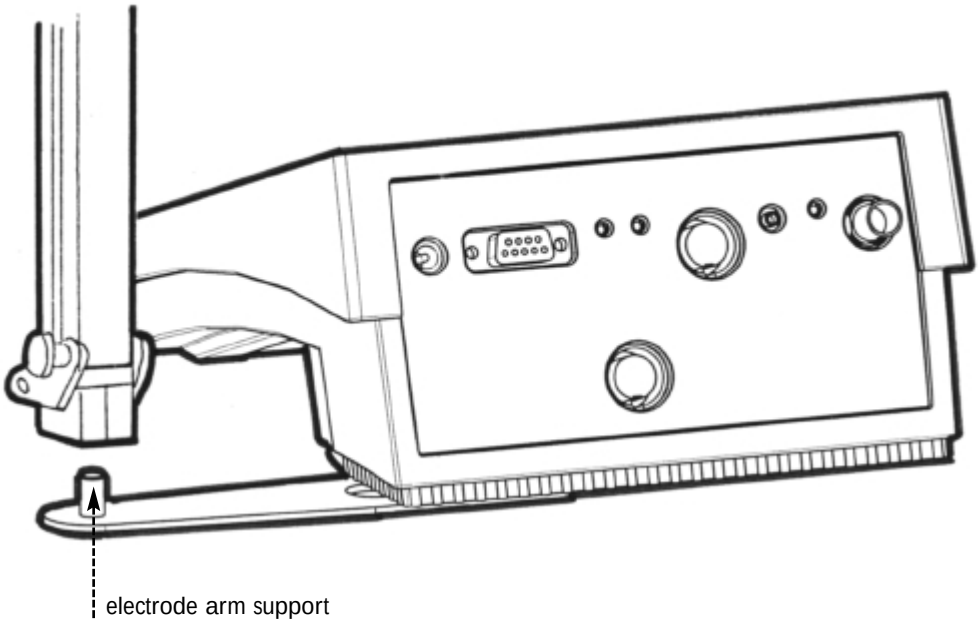
Operating Conditions

operating temperature	5-45 °C
operation humidity	5-80 % noncondensing
maximum operating altitude	2000m
installation category	II
Pollution category degree	2

1 | Review the layout and arrangement of the rear connector panel.

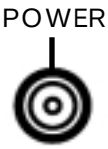


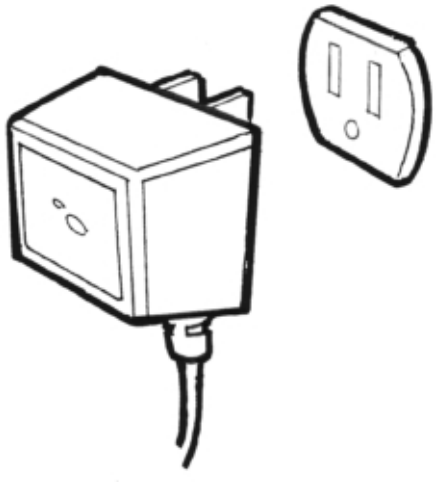
2 Connect the electrode arm to the base.



To connect RS-232, see Data Management on page 130.

3 Connect the power cable to the rear connector panel power jack and to a power source.

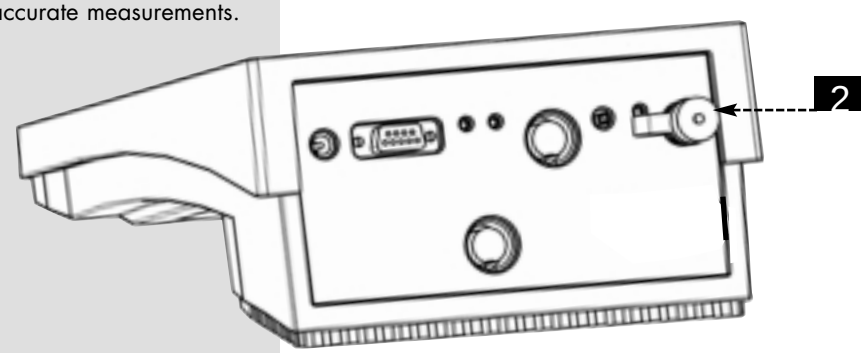




This meter allows you to use two types of pH electrodes: the conventional glass pH electrode and the AccuFET field effect transistor (FET) pH electrode. If both types of pH electrodes are connected, the meter will read the AccuFET electrode.

If both a conventional electrode and an AccuFET electrode are connected to the meter, do not put them in a solution together because you will get inaccurate measurements.

1 Carefully remove the protective cover from the end of the electrode. Before first using your glass pH electrode, or whenever the electrode is dry, soak it 2-4 hours in an electrode storage solution, pH 4 Buffer, or KCl solution.



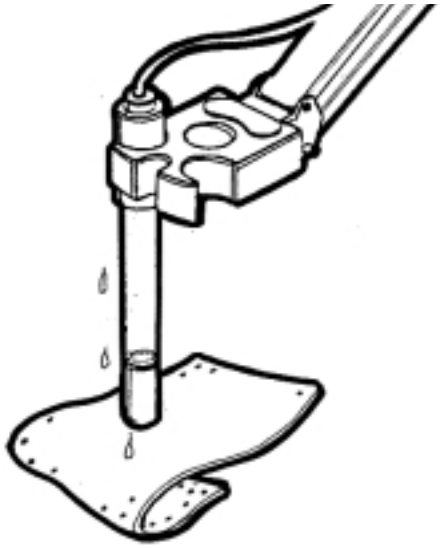
Remove the shorting cap on BNC connector. Connect the combination pH electrode by plugging it into the BNC input connector (twisting to lock in place).

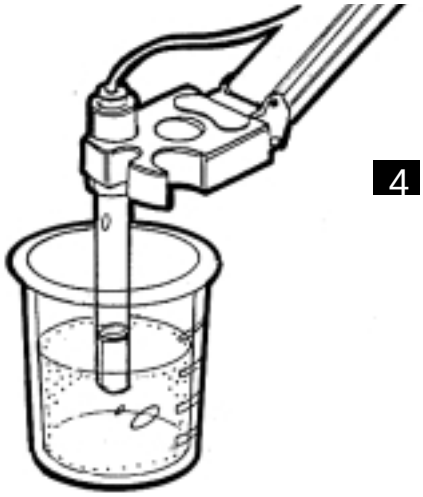
If a combination electrode isn't used, connect the indicating pH electrode into the BNC input connector. Plug the reference electrode into the reference pin jack. Also, install the ATC probe into the ATC jack.

Option: Connect the optional AccuFET electrode by plugging it into the FET jack on the back meter panel. Allow the AccuFET to warm up five minutes before use.

Do not discard the BNC shorting cap.

3 Rinse and blot-dry (don't wipe) electrodes between each measurement. Rinse electrodes with distilled or deionized water, or a portion of the next solution to be measured.



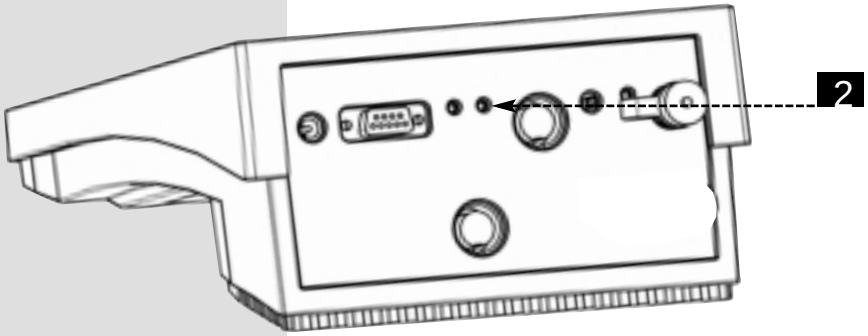


4 Between measurements, store conventional pH electrodes in electrode storage solution, pH 4 buffer, or KCl solution. Always leave the filling hole of liquid filled combination electrodes open. Refill when the level of solution gets below the manufacturer's recommended level. Store ion specific electrodes according to electrode manufacturer's recommendations.

Proper electrode care is fundamental to obtaining reliable pH measurements. Improper care of the electrode may cause the meter reading to drift, respond slowly, or produce erroneous readings. For this reason, the electrode should always be conditioned and used in accordance with manufacturer's instructions.

This meter also allows you to use two types of conductivity cells: the 2-cell conductivity cell with dual pin connector and the 4-cell conductivity cell with DIN connector. If both a 2-cell and a 4-cell conductivity probe are connected, the meter will read the 4-cell conductivity probe.

1 Carefully remove the protective cover from the end of the conductivity cell. Before using your conductivity cell, soak it for 5 to 10 minutes in distilled or deionized water.

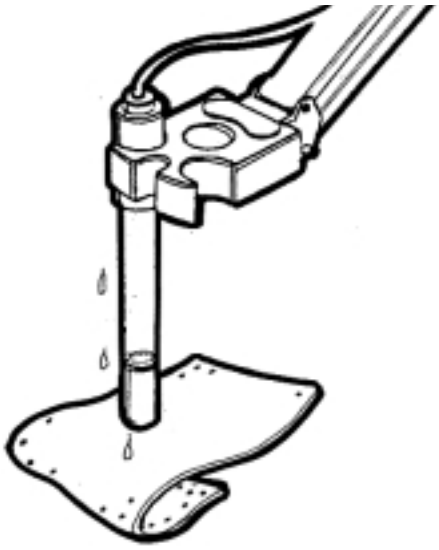


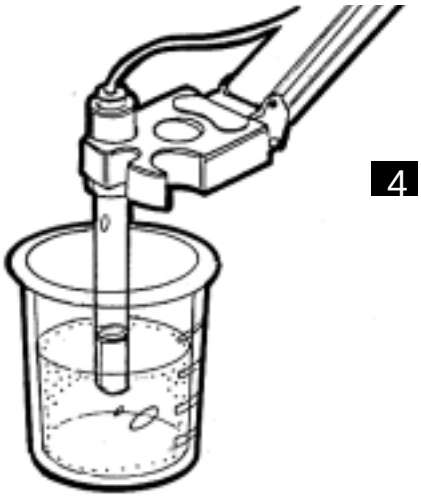
2 Connect the 2-cell conductivity cell to the 2-cell jack. Install the ATC probe in the ATC jack.

OR

Connect the 4-cell conductivity cell to the 4-cell jack. The 4-cell accumet conductivity cells have built in ATC probes. Therefore, there is no need to install a separate ATC probe.

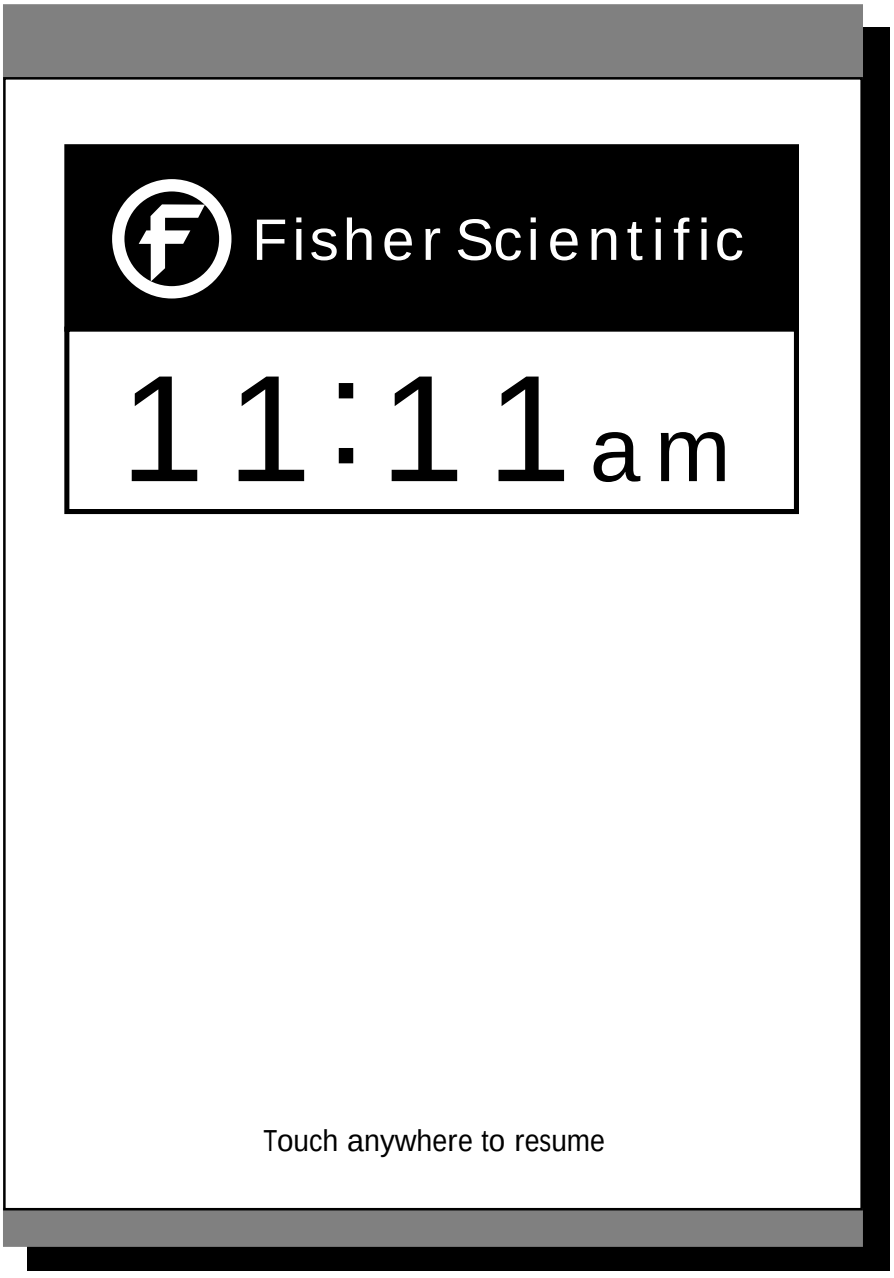
3 Rinse and blot-dry (don't wipe) probe between each measurement. Rinse probe with distilled or deionized water, or a portion of the next solution to be measured.





4 Between measurements, store conductivity probes dry.

Standby screen

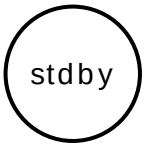


The new accumet Research benchtop pH meters operate with a state-of-the-art touch screen. The touch screen makes this the easiest meter on the market to operate and care for. When the meter is first plugged in, the STANDBY screen will appear. Touch anywhere on this screen to access the functions of the meter.

The buttons on the right side of the screen control all of the functions of the meter. A light touch on the screen is all that you need to access the various functions. Once you touch a button you will get an audible tone; the screen will not change until you lift your finger. This design prevents rapid uncontrolled scrolling through the various function screens. Function buttons and options change from screen to screen. Easy to understand prompts guide you through the operation of the meter in the selected mode. If you are ever in doubt about what to do, just touch help on the bottom right corner of the screen for detailed information about that screen.

The touch screen is made of a durable polyester material that is chemically resistant. Maintenance is simple with this meter. To clean the screen you just need to wipe it with a damp cloth and dry it with a clean dry towel. For additional information, see cleaning and troubleshooting sections of the manual (page 125).

The touch screen of your accumet Research pH meter has "buttons" along the right side of the screen that are common to many of the screens. The following indicates the function of these common buttons.

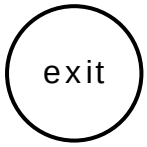


This is the standby button and it allows you to access the standby mode. When in standby, the meter will not take measurements. It is in a state of rest. When you touch stdby the meter will return to the standby screen which says "Fisher Scientific" and displays the time.

The mode button allows you to switch between the various operations of the meter. These operations, depending upon which meter you have, include four measuring modes (pH, mV, ion, conductivity) as well as a setup mode.

The enter button allows you to accept any changes that you have made on setup screens or accept values that you have input with keypads. When touched, enter will save the changes and return you to the previous screen.

The save button allows you to save multiple changes you have made on one screen as a group. It functions like the enter button does for individual changes.



The exit button allows you to leave the screen you are currently viewing and return to the previous screen without making any changes.

The help button allows you to access helpful information on any screen. When you touch the help button, information about the current screen appears. This information will include step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.

The close key appears on the bottom of all help screens and allows you to exit the help screen and return to the previous screen.

The more button appears on the help screens and allows you to advance to the next help screen for additional information.

The back button appears on the help screens and allows you to move back to a previous help screen.

This button accesses the standardization screen from the various measure modes and initiates standardization of the meter once the standardization screen is accessed.

This button is the measure button and directs the meter to measure your sample when in the Auto Read function of the pH mode.

This button will access the setup screens for the measuring mode that you are currently using. It can also be used to access the system setup screen that allows you to set parameters that are not related to measurements such as the time and the date.

The print button will send information to the output device that you have connected to your accumet meter. The output device can be a printer, data logger or a computer. In addition to this, touching the print button will also send data to the data storage center of the meter if a sample ID# has been assigned to your sample.

The arrow keys on the screen move the cursor up and down in order to highlight parameters that you would like to review or edit.

The edit button appears on the setup screens. After you have highlighted a parameter that you would like to change, the edit button allows you to access the available options for that parameter.

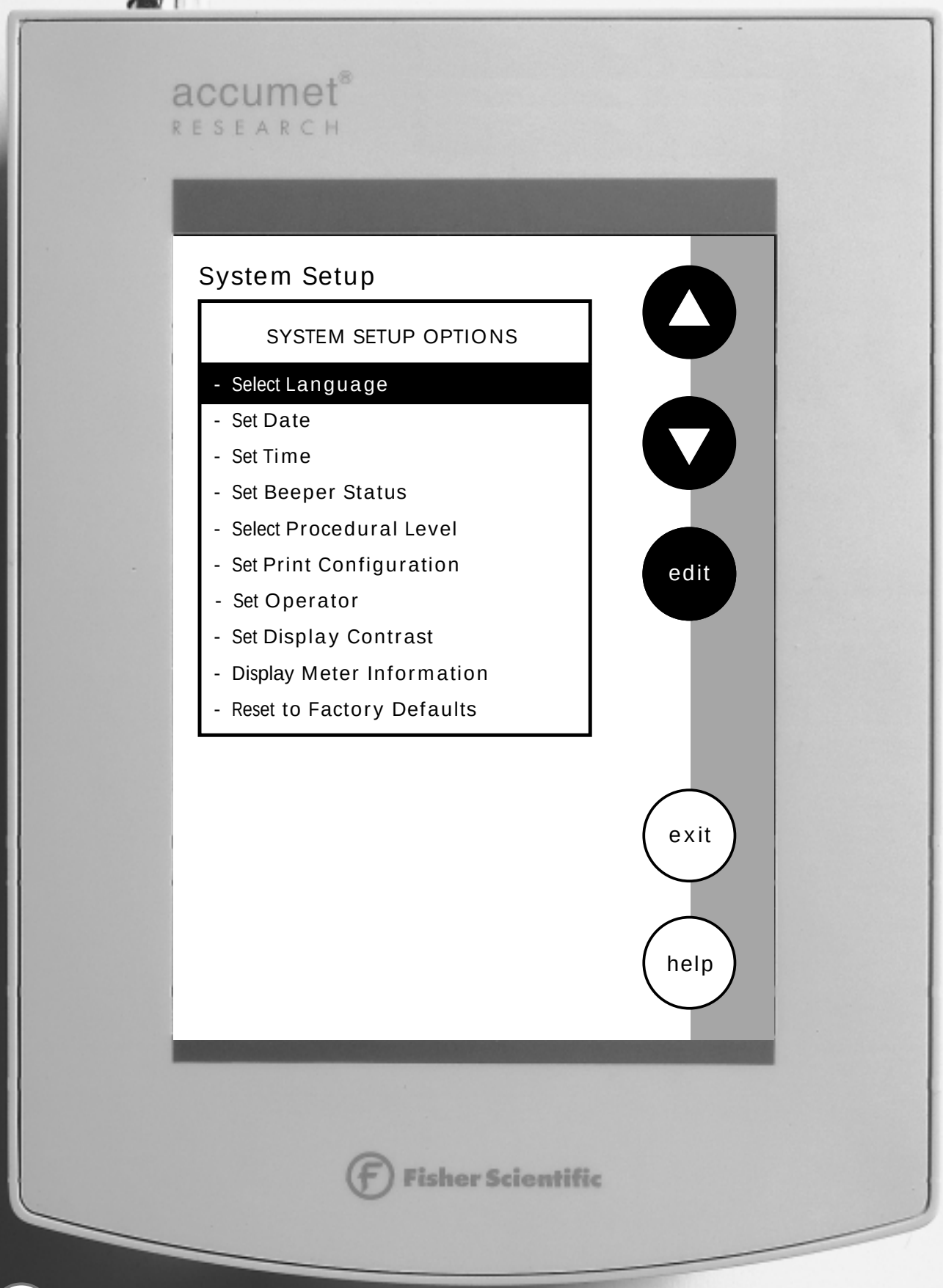
The clear button allows you to remove a setup parameter or standard buffer value from the meter's memory that may have been entered at a previous time or by a previous user that is no longer of value to you. Touching the clear button erases the value so you may enter a new one. It can also erase a parameter that you may have entered erroneously.

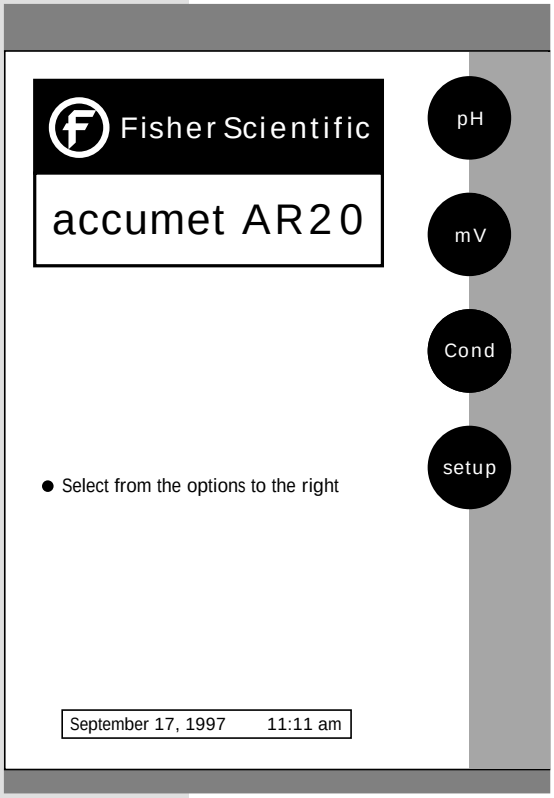
The BS button is a backspace button. It appears on keypad screens and it allows you to back up and delete a character entered in error.

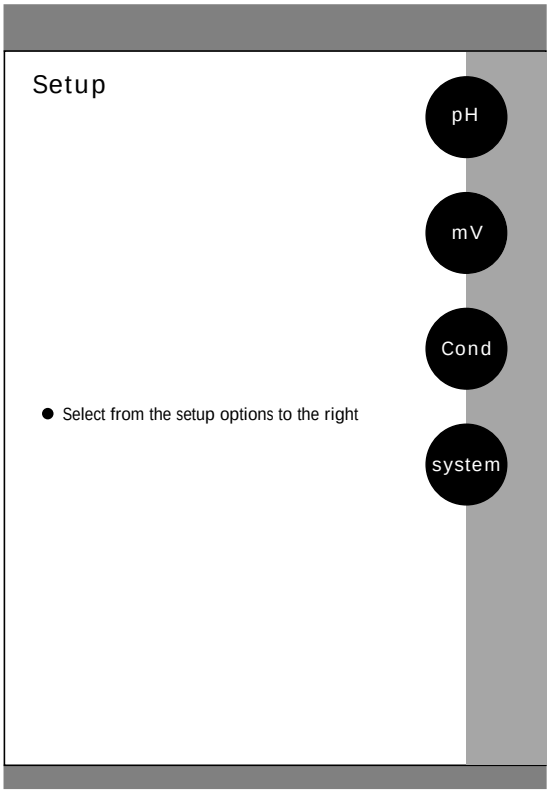
The delete button appears on the "View Stored Data" screens. This button allows you to erase the data from the memory of the meter.

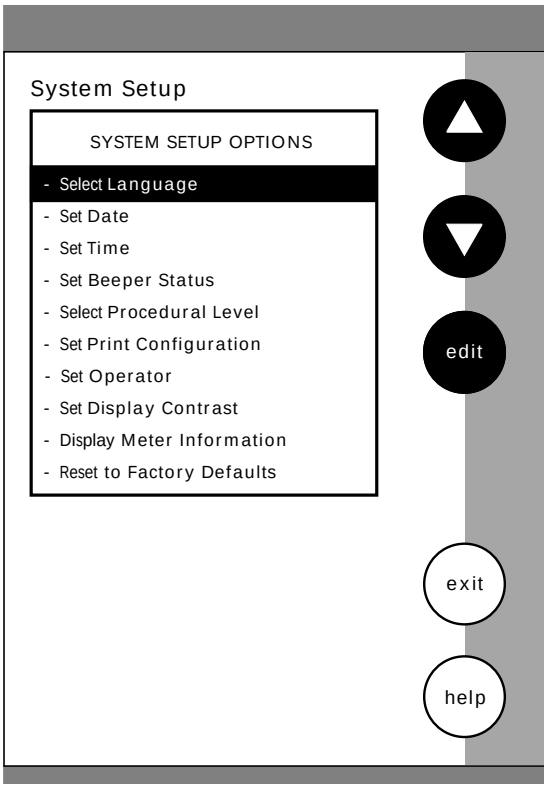
The prev button appears on the Data Screens when the data stored in the meter's memory has been accessed. It allows you to scroll through data points sorted and stored prior to the current data point displayed.

The next button appears on the Data Screens when the data stored in the meter's memory has been accessed. It allows you to scroll through data points sorted and stored after the current data point displayed.


accumet®
RESEARCH
System Setup
SYSTEM SETUP OPTIONS
- Select Language
- Set Date
- Set Time
- Set Beeper Status
- Select Procedural Level
- Set Print Configuration
- Set Operator
- Set Display Contrast
- Display Meter Information
- Reset to Factory Defaults
edit
exit
help
Fisher Scientific







The system setup function allows you to customize the meter display options to meet your personal preference. Once set, these will rarely need to be changed.

To access System Setup

1. Touch anywhere on the Standby screen.
2. Touch setup on the Main screen.
3. Touch system on the Setup screen.

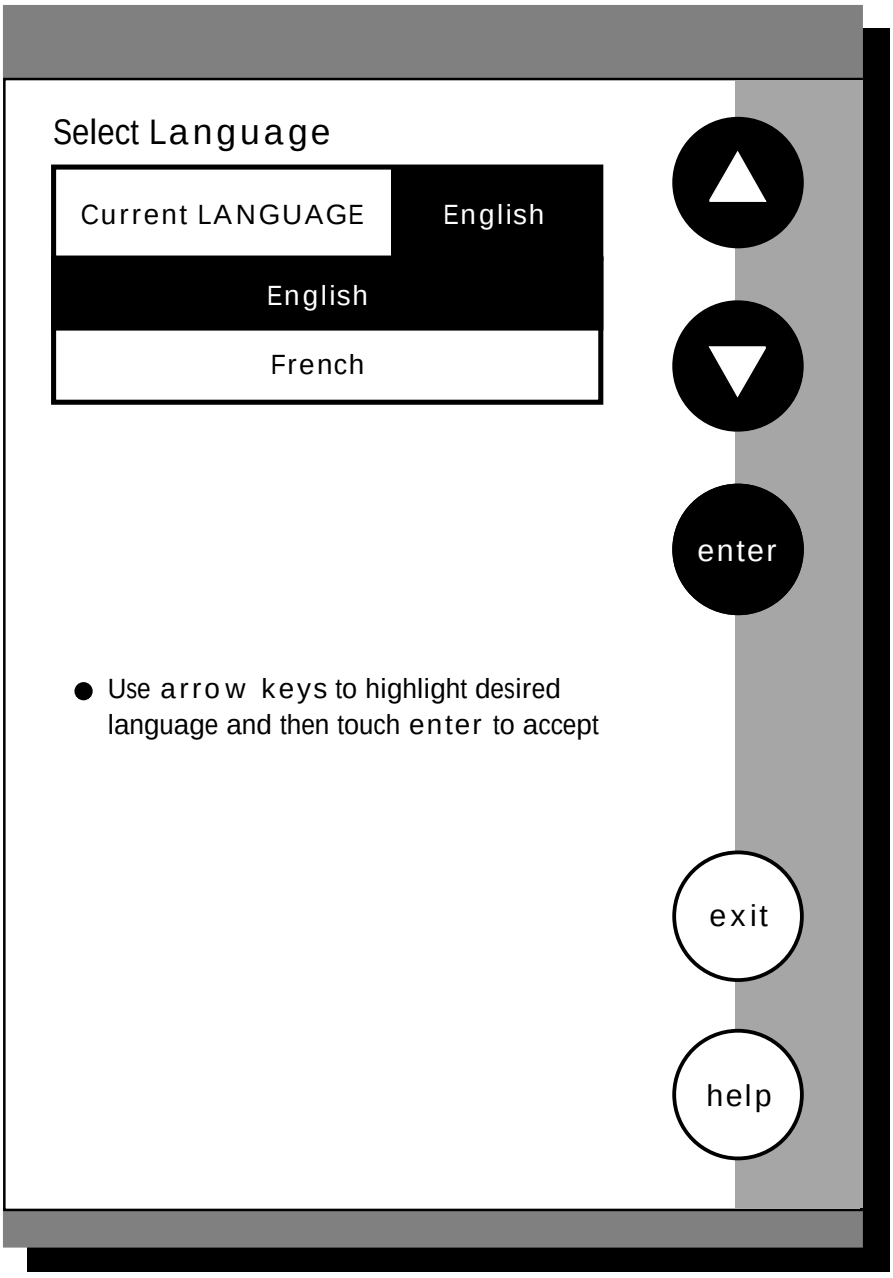
The System setup options are now displayed on the screen.

To access a System Setup option

Use the arrow keys to scroll through the setup options and highlight the option to be reviewed.

1. Touch edit to view the current status of the selected option.
2.

The following is a detailed description of the System setup option screens.



- Use arrow keys to highlight desired language and then touch enter to accept

Remember, HELP is always just a touch of the button away.

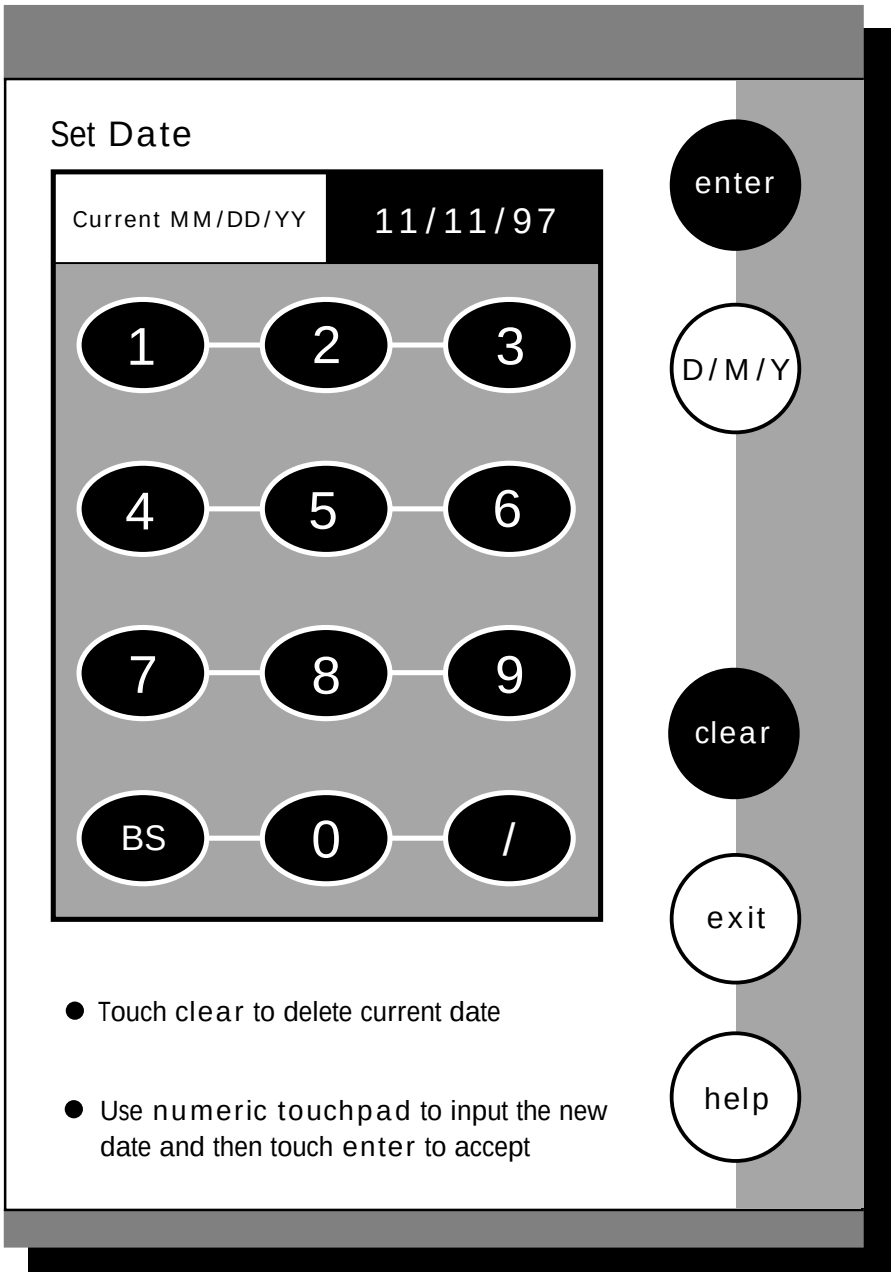
This option allows you to choose the language in which all prompts and directions will appear on the touch screen.

To Select Language

1. Access the Select Language screen from the System Setup screen. The current language is displayed on the screen.
2. Use the arrow keys to highlight the desired language.
3. Touch enter to accept the language and return to the System Setup screen.

   OR

   Touch exit to return to the System Setup screen, without making any changes.



This screen can be used to set the present date which will be displayed on the measure screens. This date will also be printed on demand and stored in the data storage center of the meter when data is saved. There are two format options for the date: month/day/year (M/D/Y) or the European format of day/month/year (D/M/Y).

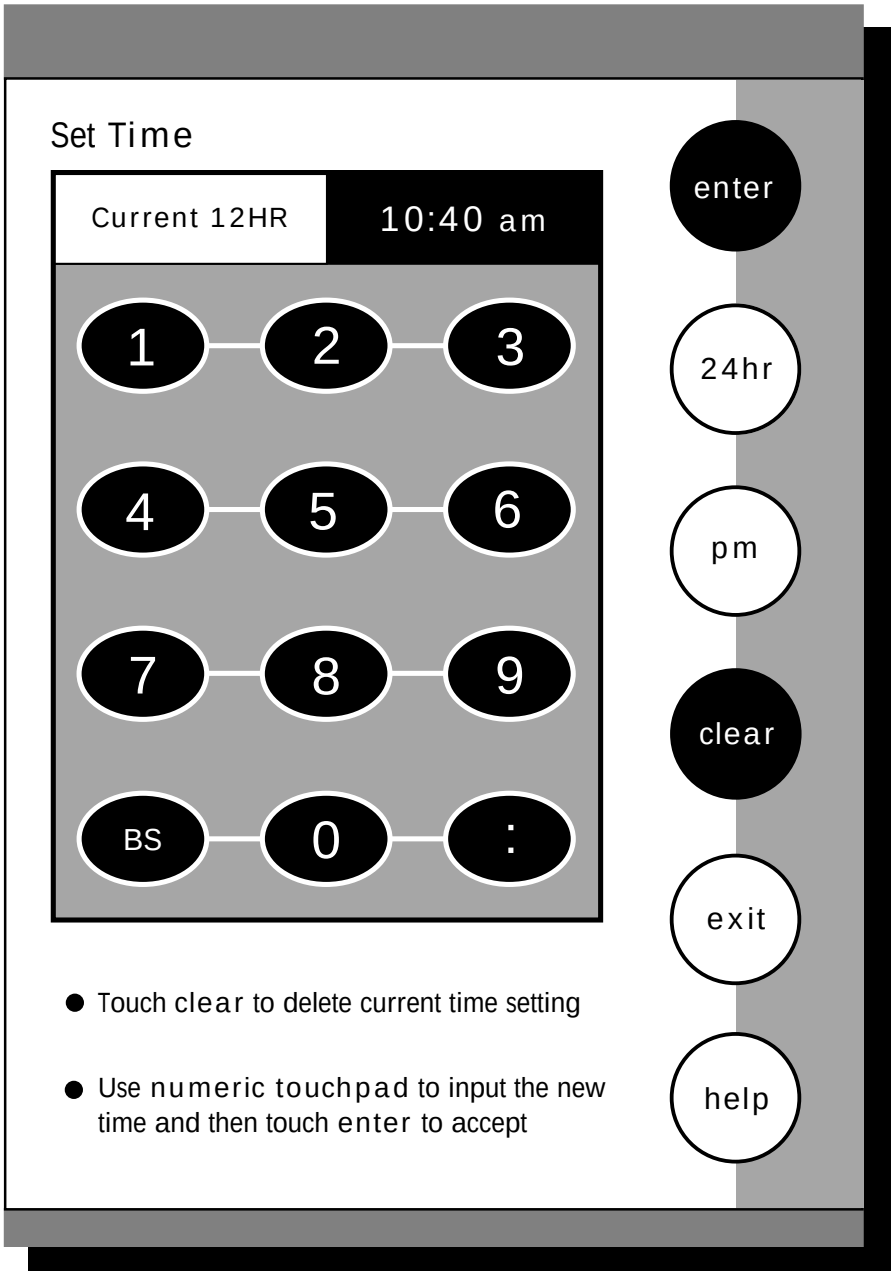
To Set Date

1. Access the Set Date screen from the System Setup screen. The current date and numeric keypad are displayed on the screen.
2. Touch clear to delete the current entry.
3. Touch D/M/Y or M/D/Y to set the date format.
4. Use the numeric touch pad to enter the desired date, separating the day, the month and the year by touching the / key on the keypad.
5. Touch enter to accept the date in the current format.

   OR

   Touch exit to return to the System Setup screen, without making any changes.

If you do not use the /, the meter will not accept the date.



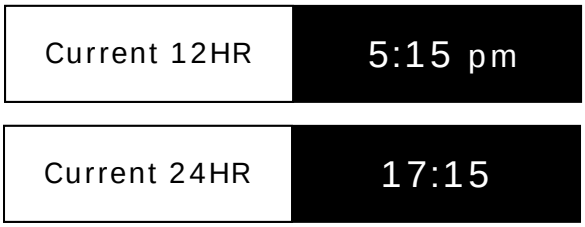
This screen can be used to set the present time which will be displayed on the measure screens. This time will also be printed on demand and stored in the data storage center of the meter when data is saved. There are two format options for the time. The clock can be set as either a 12 hour clock or a 24 hour clock.

To Set Time

1. Access the Set Time screen from the System Setup screen. The current time and numeric keypad are displayed on the screen.

2. Touch clear to delete the current entry.

3. Touch the 24hr or 12hr button to format the clock as either a 12 hour or a 24 hour clock.



4. Touch am or pm to set the appropriate time.

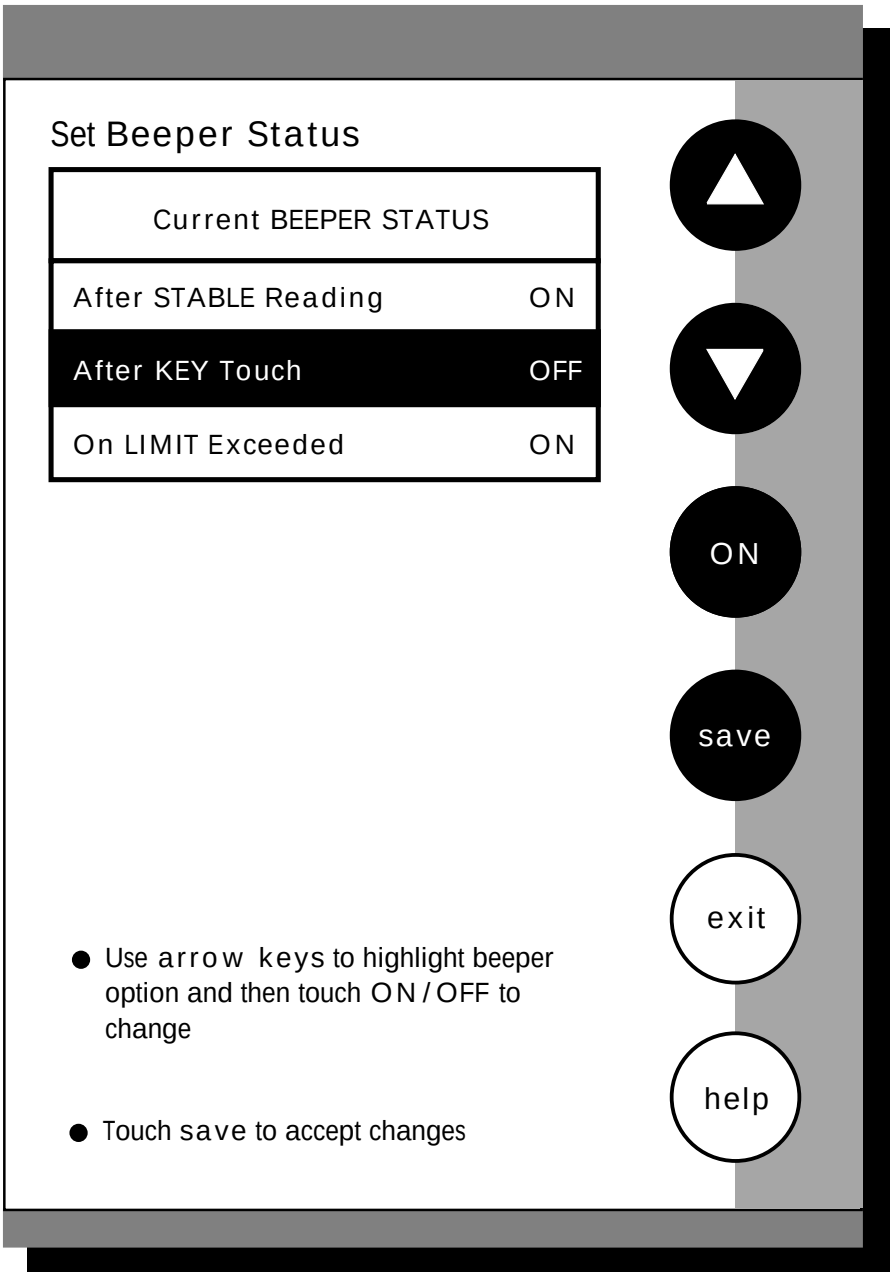
5. Use the numeric touch pad to enter the desired time, separating the hour and the minutes by touching the : key on the keypad.

6. Touch enter to accept the time in the current format.

   OR

   Touch exit to return to the System Setup screen, without making any changes.

If you do not use the :, the meter will not accept the time.



Remember, HELP is always just a touch of the button away.

This screen allows you to turn on or turn off the beeper. You may choose to have an audible signal when the meter recognizes that the current measurement is stable, each time a function button is touched and/or when the set limits of a measurement mode have been exceeded.

After STABLE Reading
When active, the meter delivers an audible tone each time the meter recognizes the current measurement as stable. If deactivated, you will not hear an audible tone at a stable measurement. You will still see the STABLE indicator even if there is no audible tone.

After KEY Activation
When active, the meter delivers an audible tone each time you touch a function button or a key on an alphanumeric keypad. If deactivated, you will not hear a tone after a key touch. The changes will only be visible on the screen.

On LIMIT Exceeded
When active, the meter delivers an audible tone each time the set limits in a measurement mode have been exceeded. If deactivated, you will not hear an alarm tone when the limits in the measurement modes have been exceeded. You will see the LIMIT indicator on the measurement screen. For additional information on the Alarm Limits of the meter, see the setup sections of this manual for each of the measurement modes.

To Set Beeper Status

1. Access the Set Beeper Status screen from the System Setup screen. The current beeper status is displayed on the screen.

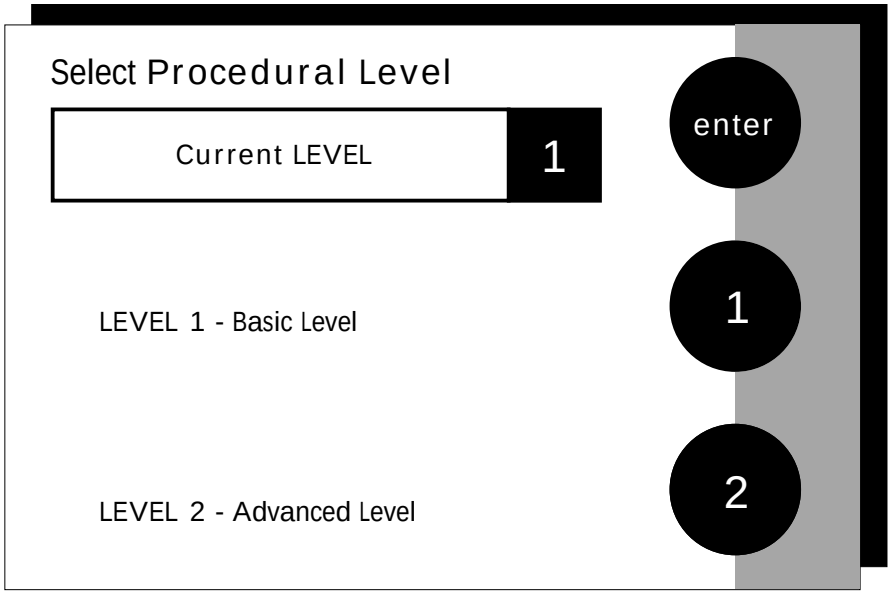
2. Use the arrow keys to highlight the beeper status option that you would like to modify.

3. Touch ON or OFF until the desired status is visible in the current beeper status box.

4. Touch save to accept the changes and return to the System Setup screen.

   OR

   Touch exit to return to the System Setup screen, without making any changes.



Procedural Level 1

September 17, 1997	11:11 am
Temperature	25.0 °C
Electrode Performance	100%

Procedural Level 2

September 17, 1997			11:11 am
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

This Selection screen allows you to choose the amount of information that you want to have displayed on the screen. There are two levels to choose from. Both of the levels provide identical results. The amount of information appearing on the measure screens and the number of setup parameters you can manipulate will vary from Basic to Advanced procedural levels.

LEVEL 1 - Basic Level
This level option offers a full set of prompts to guide you through the basic operation of the meter. The information provided on the screen is minimal to reduce clutter. It includes the measurement and the last standardization time and buffer values. The data box at the bottom of the measure screen includes the current date, time, sample temperature and the electrode performance. In addition to the limited information appearing on the measure screen, there are also fewer options available to you in the setup screens of the various measurement modes.

LEVEL 2 - Advanced Level
This option allows you access to all of the features available on the meter. A full set of prompts is available on virtually every screen to lead you through the operation of the meter. You are also given access to all setup parameters for the various measurement modes. Any parameter not appearing on the Basic Level Setup screens will maintain the value previously set in the Advanced Level Setup screens. They will not automatically default to factory default settings. This is ideal if you want to "lock" in a parameter in the Advanced Level and switch to the Basic Level so others cannot accidentally modify the parameter.

To Select Procedural Level

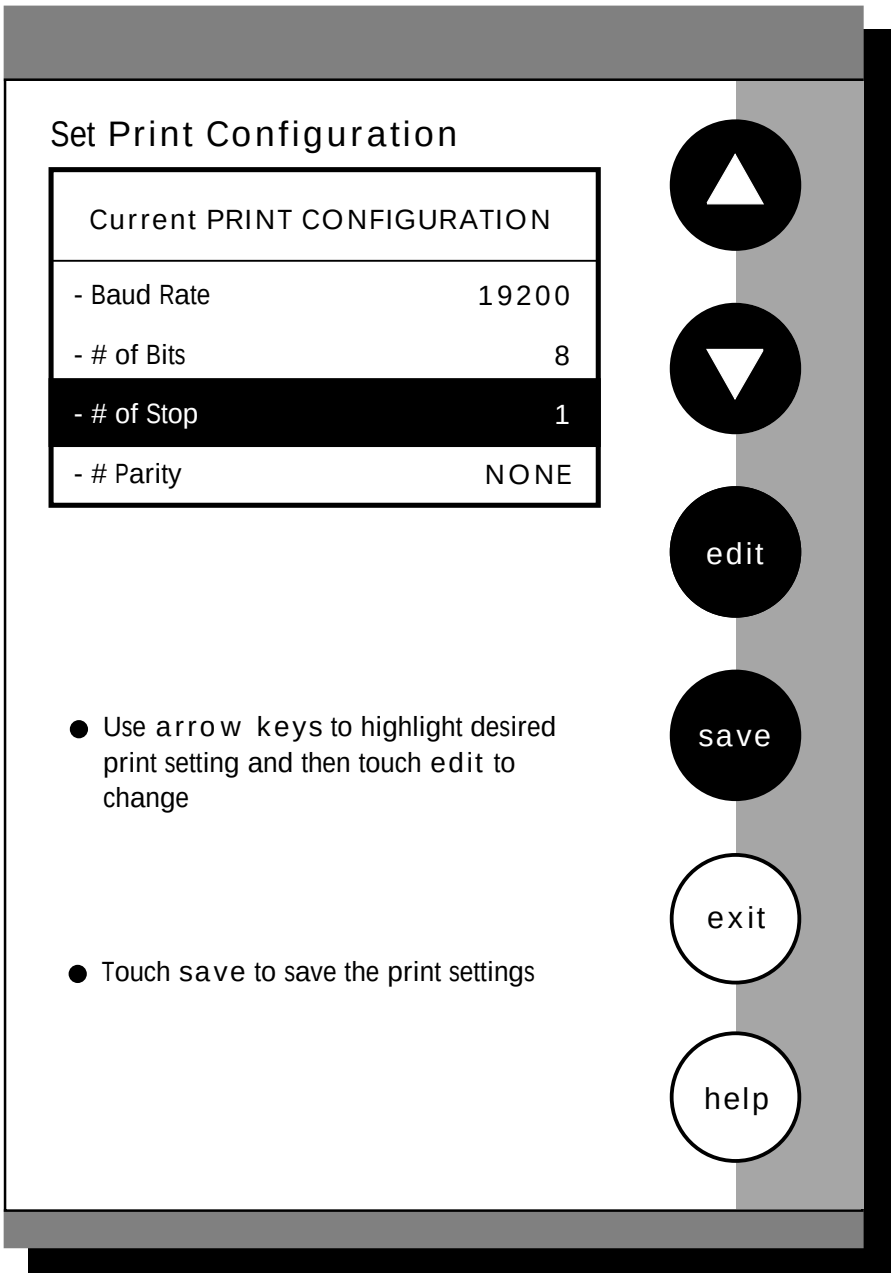
1. Access the Select Procedural Level screen from the System Setup screen. The current procedural level is displayed on the screen.

2. Use the numbered buttons on the right of the screen to select the desired procedural level.

3. Touch enter to accept the procedural level and return to the System Setup screen.

   OR

   Touch exit to return to the System Setup screen, without making any changes.



You can adjust the print configuration of the meter from this screen. The configuration of the following screens must match the configuration of the printer or computer to which the data will be sent.

To Set Print Configuration

1. Access the Print Configuration screen from the System Setup screen. The current Print Configuration is displayed on the screen.

2. Use the arrow keys to highlight the configuration option to be modified.

3. Touch edit to access the parameters for the highlighted option.

   OR

   Touch exit to return to the System Setup screen, without making any changes.

This configuration option will control the speed at which the data will be transmitted to the printer. This parameter needs to match the baud rate designated by the printer or computer.

To Set Baud Rate

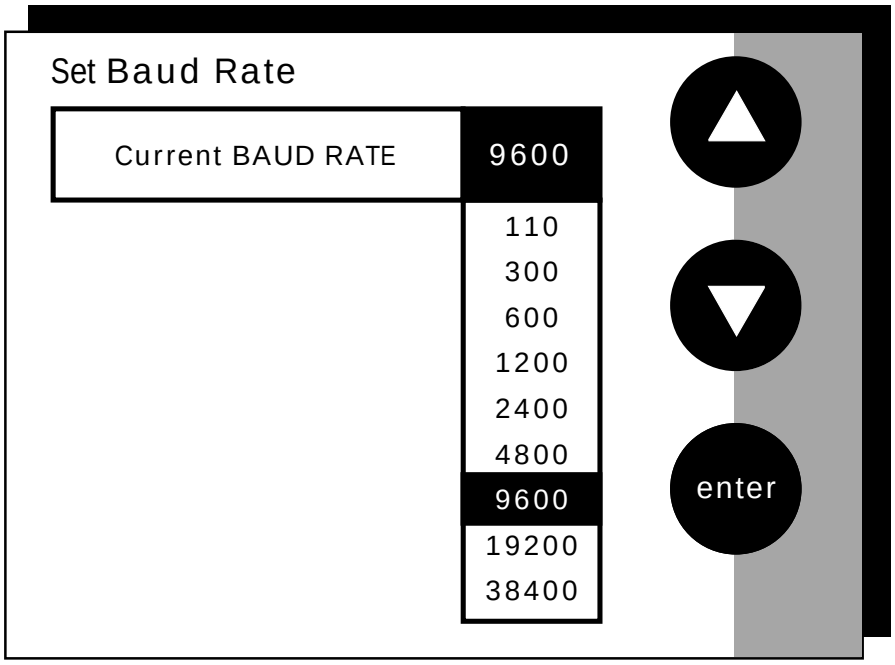
1. Access the Set Baud Rate screen from the Set Print Configuration screen. The current baud rate is displayed on the screen.

2. Use the arrow keys to highlight the baud rate option that matches the baud rate of your printer or computer.

3. Touch enter to accept the baud rate and return to the Set Print Configuration screen.

   OR

   Touch exit to return to the Set Print Configuration screen, without making any changes.



To Set Number of Bits

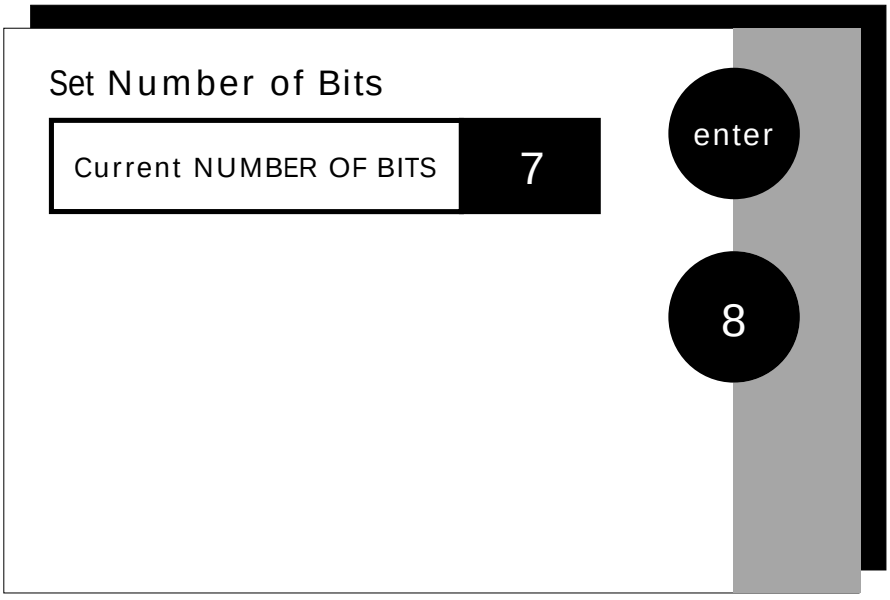
1. Access the Set Number of Bits screen from the Set Print Configuration screen. The current number of bits is displayed on the screen.

2. Touch 7 or 8 to select the number of bits.

3. Touch enter to accept the bit value and return to the Set Print Configuration screen.

   OR

   Touch exit to return to the Set Print Configuration screen, without making any changes.



To Set Stop Bits

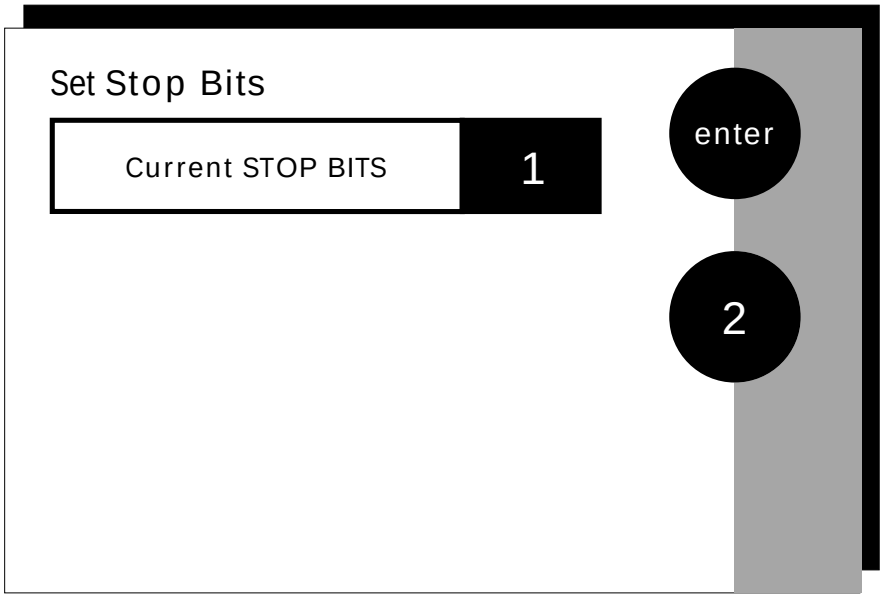
1. Access the Set Stop Bits screen from the Set Print Configuration screen. The current number of bits is displayed on the screen.

2. Touch 1 or 2 to set the desired number of stop bits.

3. Touch enter to accept the stop bit value and return to the Set Print Configuration screen.

   OR

   Touch exit to return to the Set Print Configuration screen, without making any changes.



To Set Parity

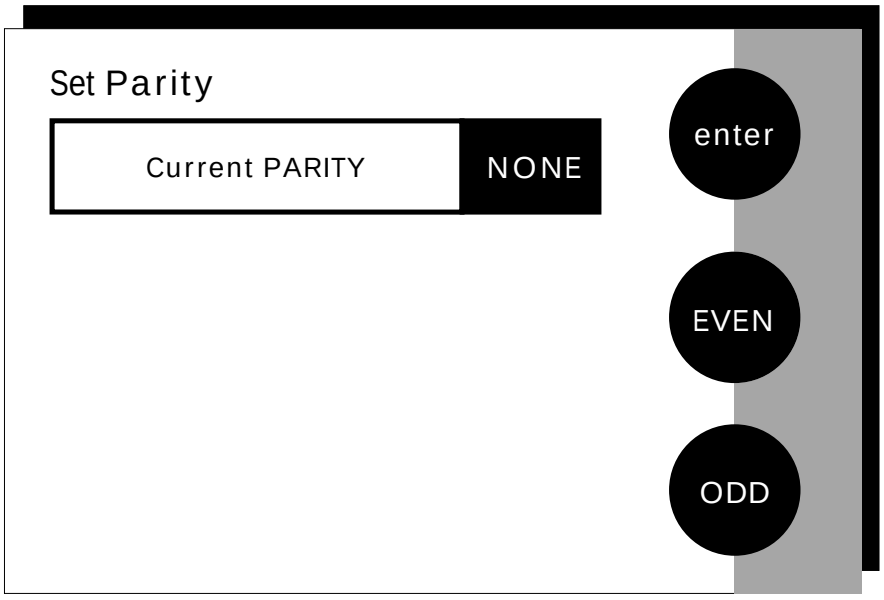
1. Access the Set Parity screen from the Set Print Configuration screen. The current Parity is displayed on the screen.

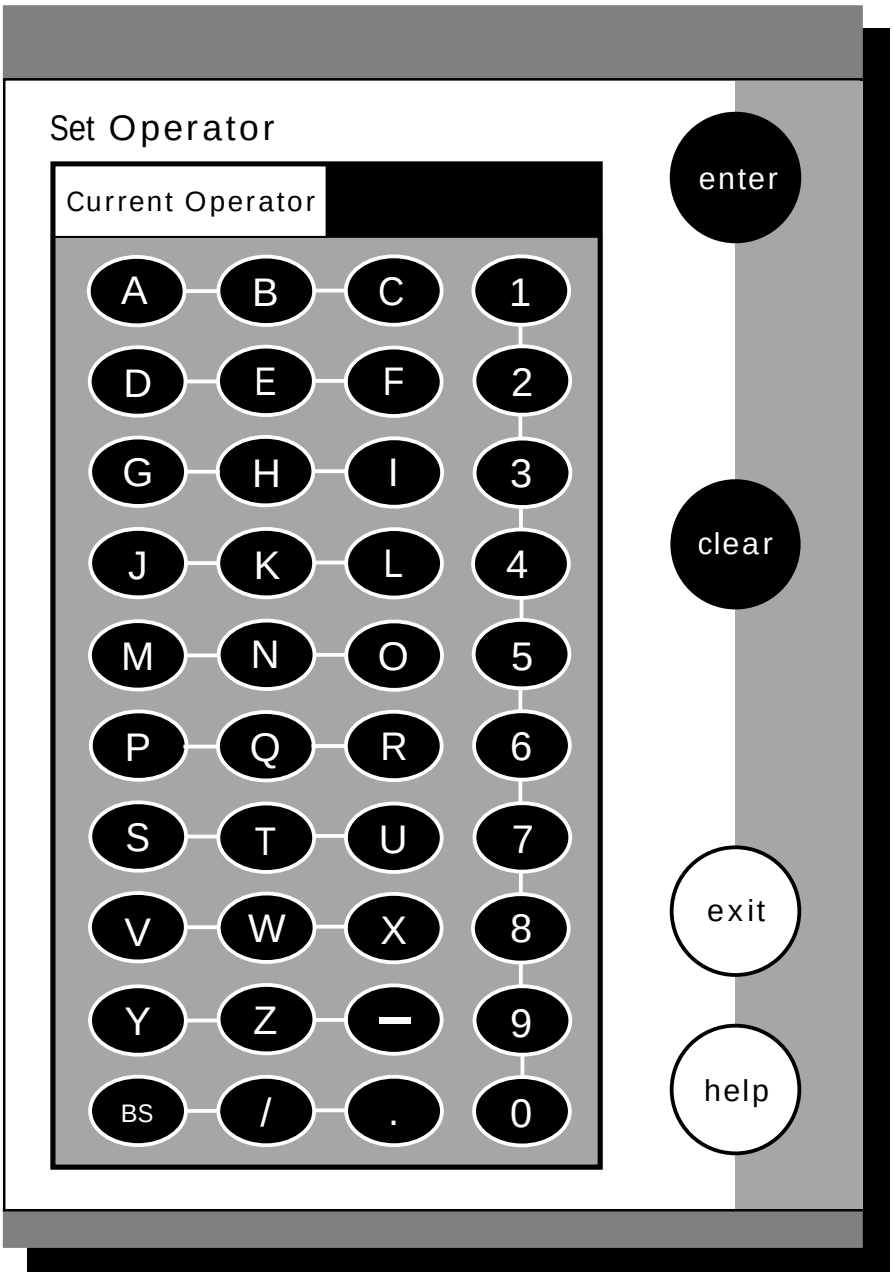
2. Touch ODD or EVEN or NONE to set the desired parity.

3. Touch enter to accept the parity setting and return to the Set Print Configuration screen.

   OR

   Touch exit to return to the Set Print Configuration screen, without making any changes.





This option allows you to identify the user of the meter. This information can be saved in the meter's memory. It can also be printed out with measurement data on demand. The operator identification can be up to 9 characters in length.

To Set Operator

1. Access the Set Operator screen from the System Setup screen. The current operator identification is displayed on the screen.

2. Touch clear to remove the current operator identification.

3. Use the alphanumeric keys on the touch screen to enter the desired operator identification. The BS button will allow you to backspace to remove a character that was incorrectly entered. The operator identification code can be a maximum of 9 characters in length.

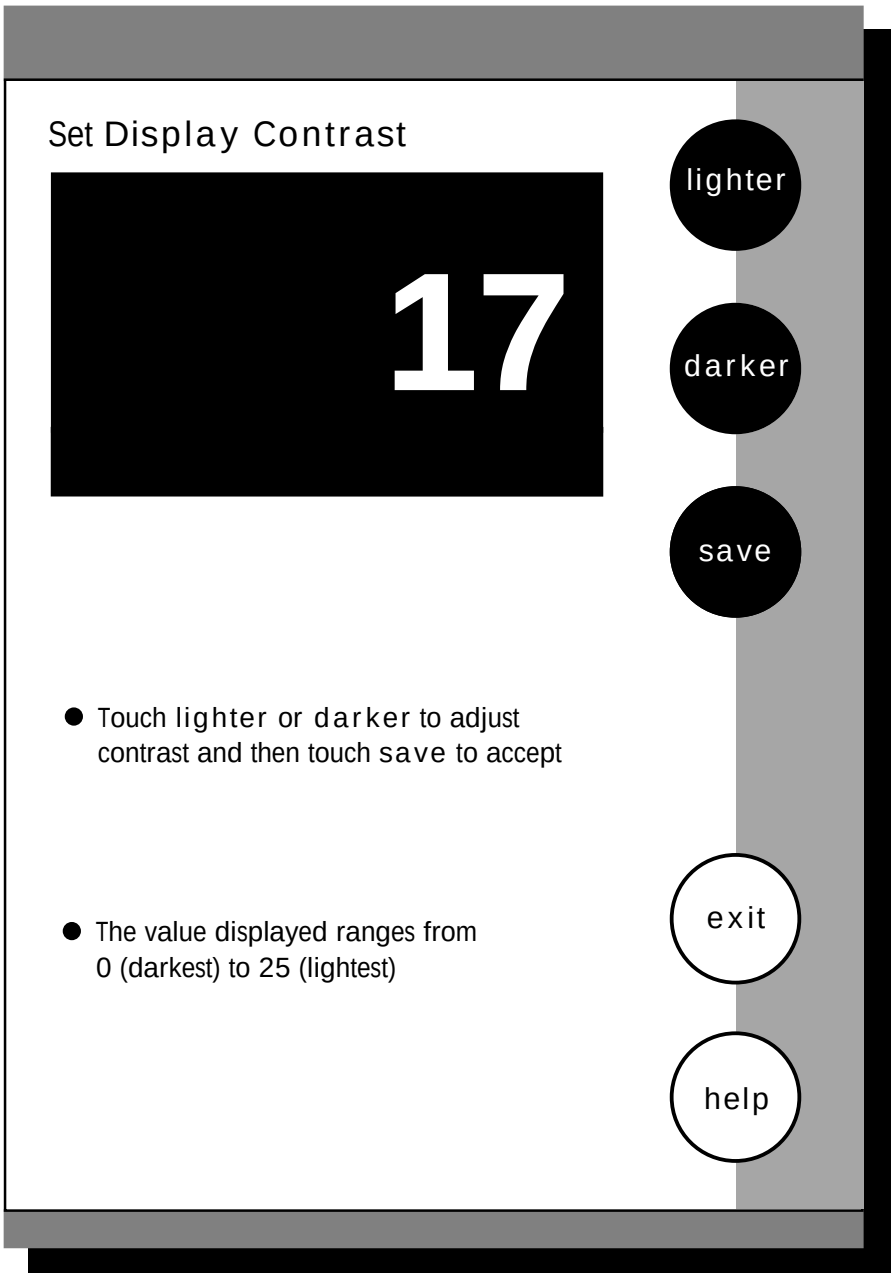
4. Touch enter to accept the new operator identification.

   OR

   To deactivate the operator identification:
   1. Touch clear to erase the current user identification.
   2. Touch enter to return to the System Setup screen.

   OR

   Touch exit to return to the System Setup screen, without making any changes.



- Touch lighter or darker to adjust contrast and then touch save to accept
- The value displayed ranges from 0 (darkest) to 25 (lightest)

This option allows you to change the contrast on the screen to improve the readability of the information presented on the screen. The numbering system that appears on the screen is from 0 to 25. The darkest setting is 0 and the lightest setting is 25.

To Set Display Contrast

1. Access the Set Display Contrast screen from the System Setup screen. The current display contrast value is displayed on the screen.

2. Use the lighter or darker button to adjust the contrast of the screen to the desired level.

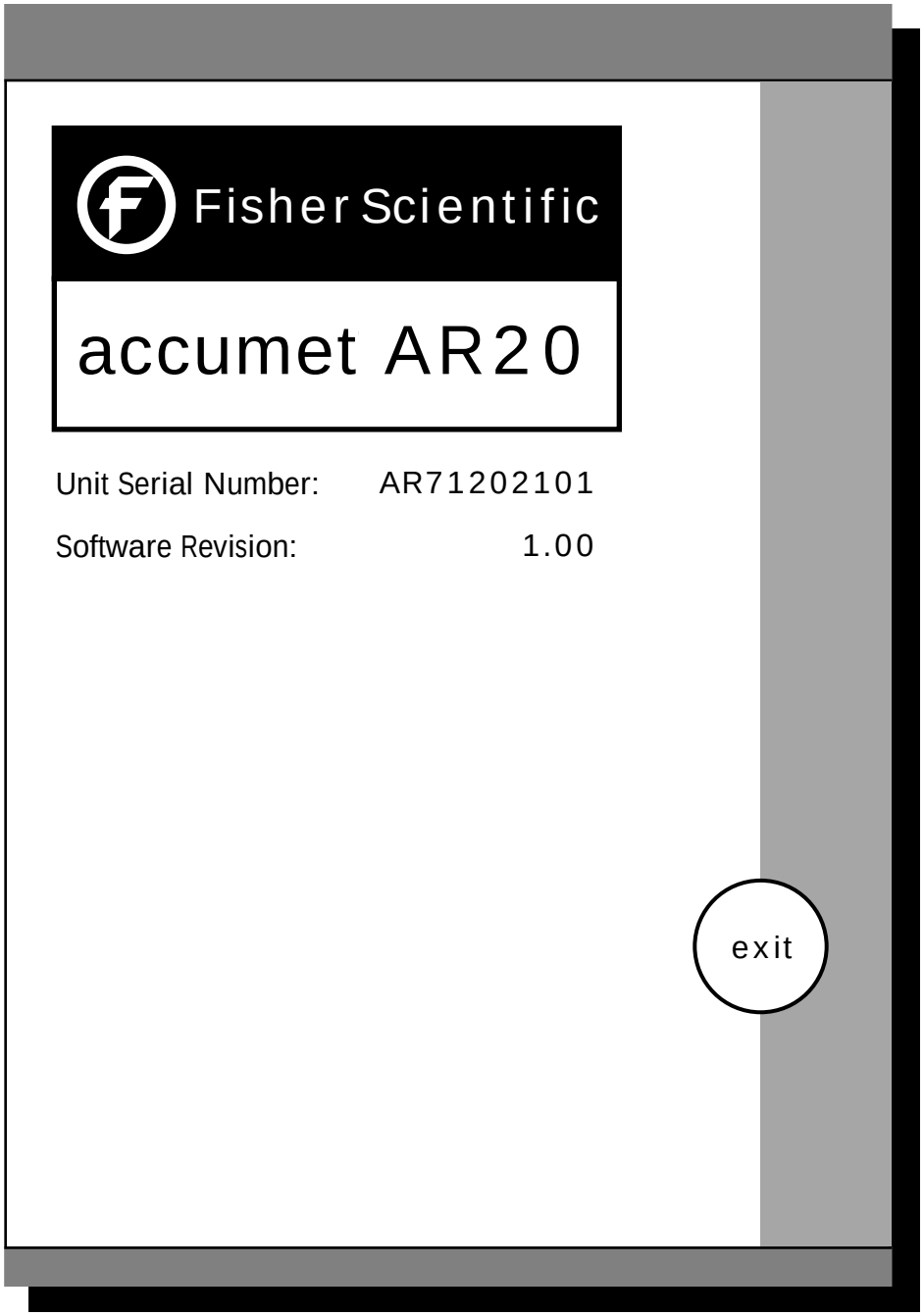
3. Touch save to accept the contrast setting and return to the System Setup screen.

   OR

   Touch exit to return to the System Setup screen, without making any changes.

Note: The display contrast of the screen is affected by the internal temperature of the meter. The meter will warm up after being plugged in. During this period (approximately 20 minutes), the display contrast of the screen will get lighter. You may need to adjust the contrast during this period to meet your specifications.

This screen displays the model number, serial number and current software revision of your meter.



This screen allows you to reset all functions and setup parameters of the meter to the settings originally programmed at the factory.

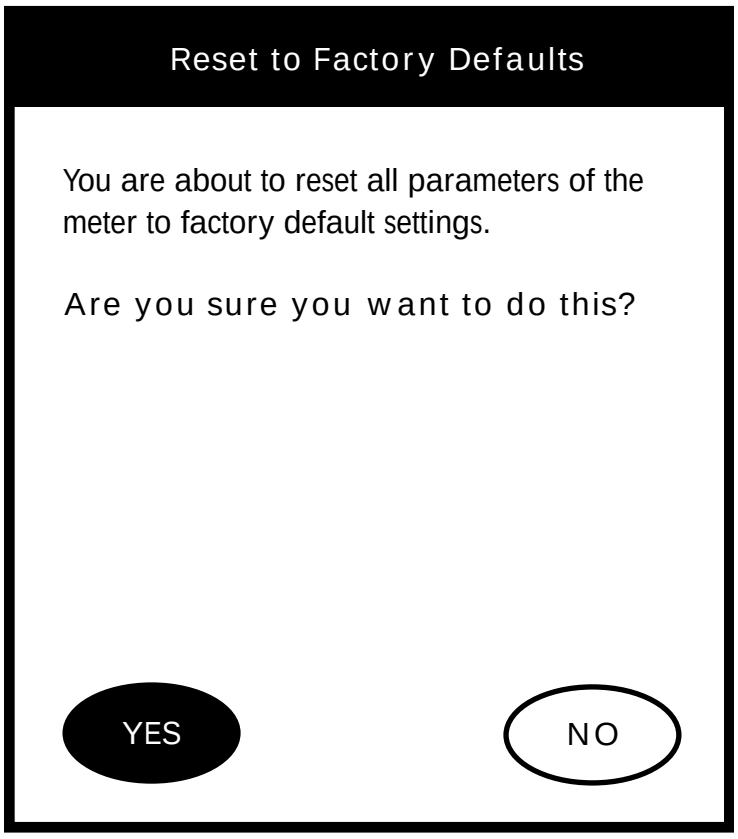
To Reset to Factory Defaults

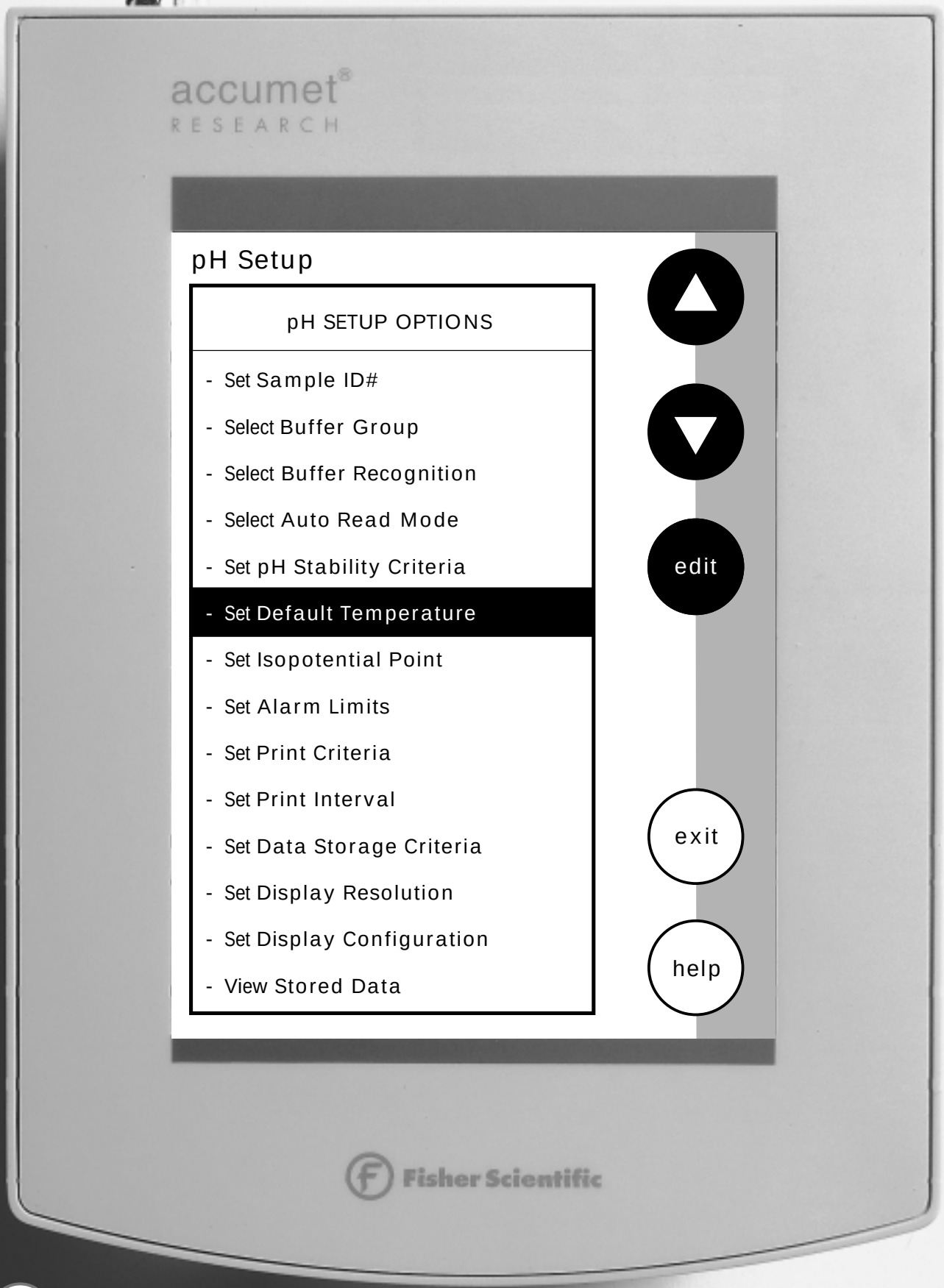
1. Access the Reset to Factory Defaults screen from the System Setup screen.

2. Touch YES to reset all parameters to the original factory default settings.

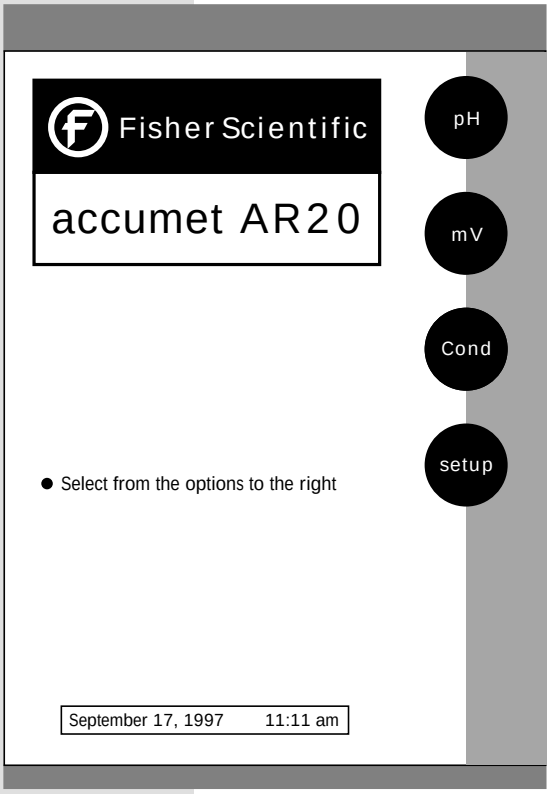
   OR

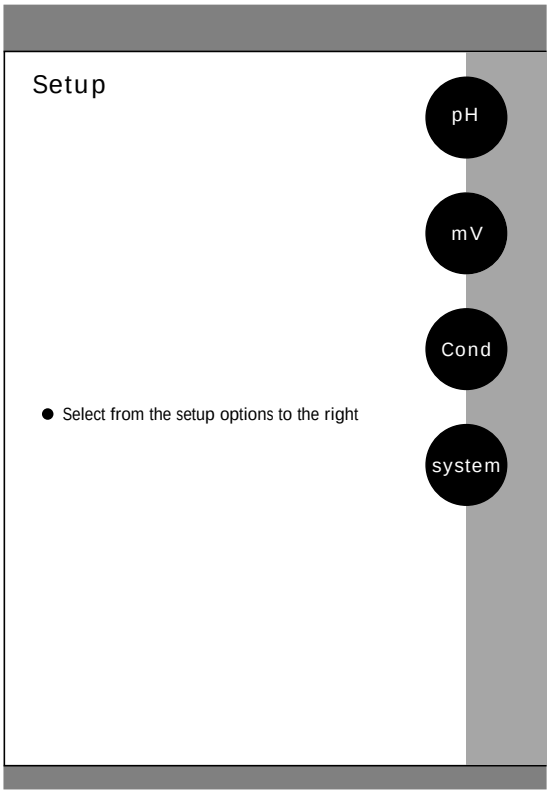
   Touch NO to return to the System Setup screen, without making any changes.

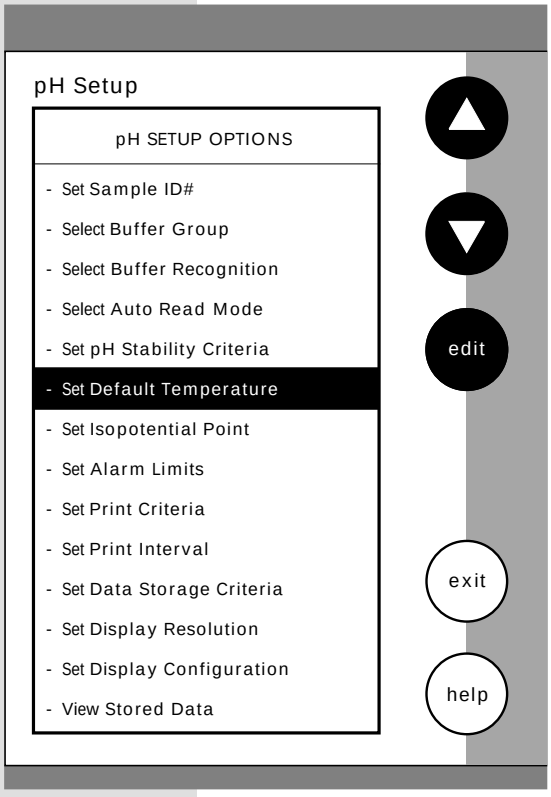



accumet®
RESEARCH
pH Setup
pH SETUP OPTIONS
- Set Sample ID#
- Select Buffer Group
- Select Buffer Recognition
- Select Auto Read Mode
- Set pH Stability Criteria
- Set Default Temperature
- Set Isopotential Point
- Set Alarm Limits
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Display Resolution
- Set Display Configuration
- View Stored Data
edit
exit
help
Fisher Scientific

The operating parameters of the pH mode can be set and controlled from the pH Setup screen. The following sections will guide you through the various options available for the pH setup mode.



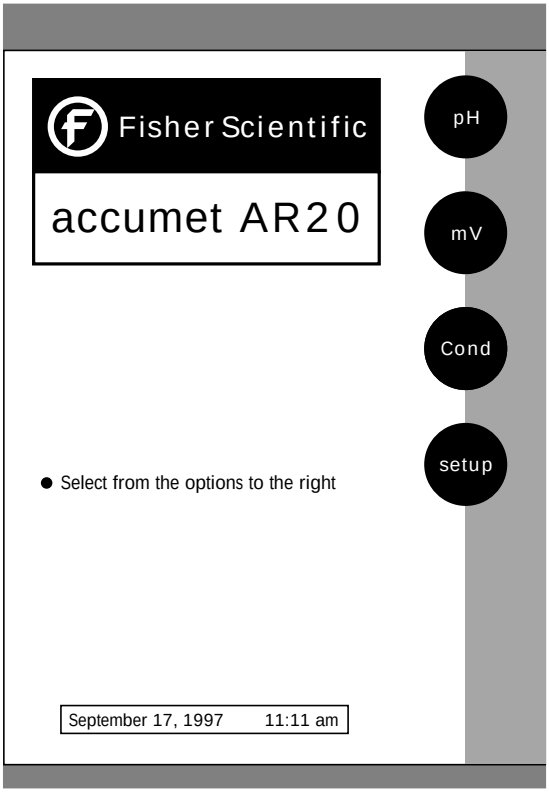


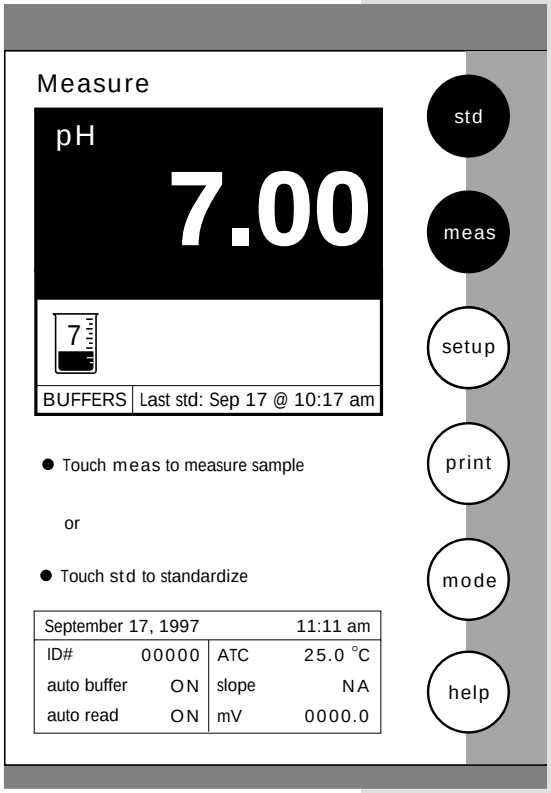


There are two ways to access the pH Setup screen.

From the Setup screen

1. Touch setup on the main screen. Touch pH to access the pH Setup screen.
2. Use the arrow keys to highlight the setup option that you would like to review.
3. Touch edit to access the screen for the selected option.



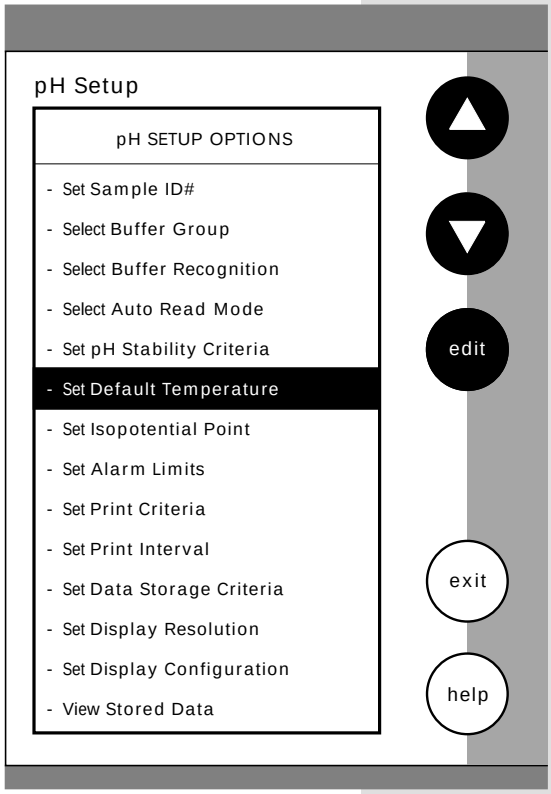


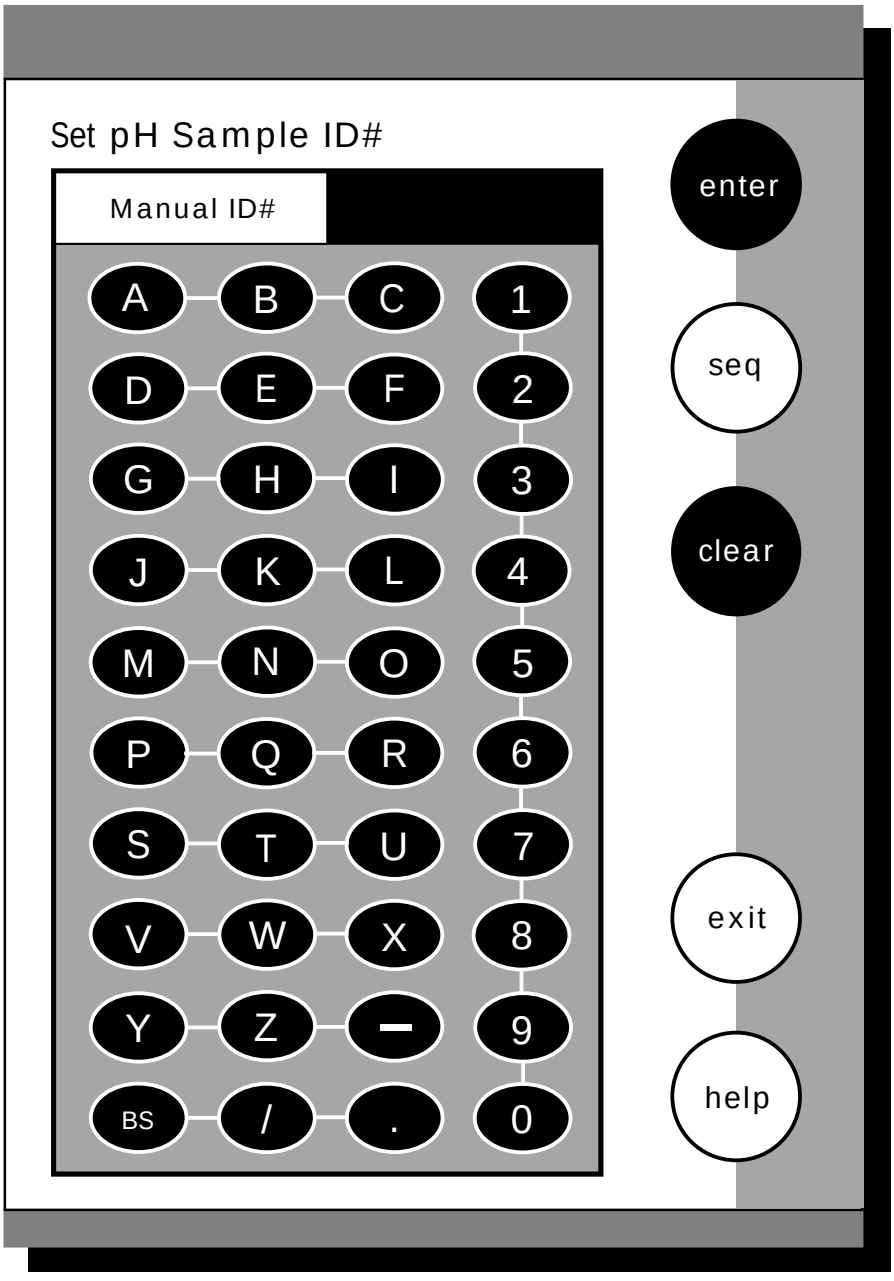
From the pH Measure screen

1 Touch pH on the main screen to access the pH mode. Touch setup on the pH Measure screen. The pH Setup screen is now displayed.

2 Use the arrow keys to highlight the setup option that you would like to review.

3 Touch edit to access the screen for the selected option.



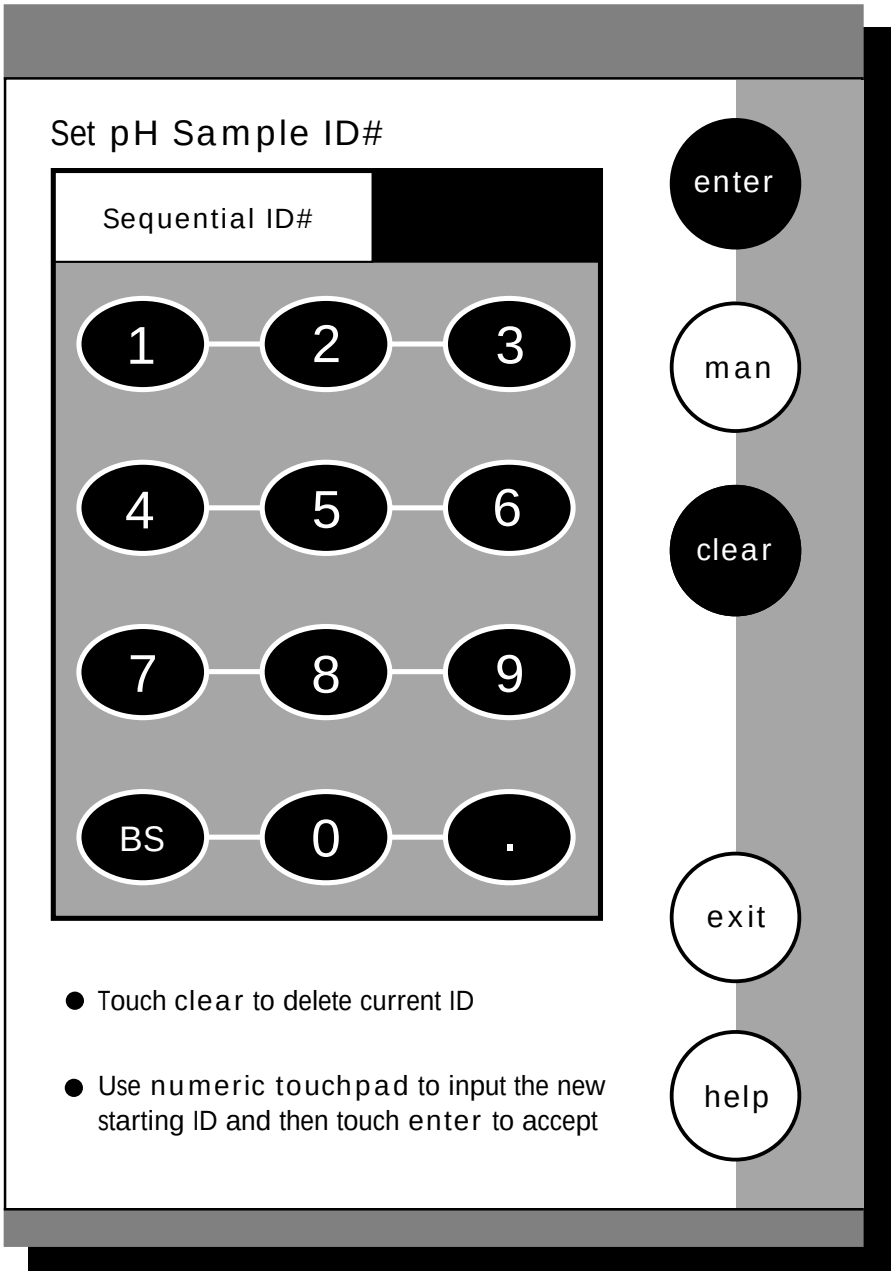


When this option is active, each time you touch print on the Measure screen the pH value along with the date/time/channel and the sample ID# will be sent to data storage. (See Data Storage Criteria page 70 for additional information on saved parameters.) You can manually enter an alphanumeric identification number of up to 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

To Set Sample ID#

Manual ID# Assignment

1. Access the Set Sample ID# screen from the pH (mV, Conductivity) Setup screen.
2. Touch man for manual ID# entry. The current ID# is displayed on the screen.
3. Touch clear to delete the current ID#.
4. Use the alphanumeric keypad on the screen to enter the desired Sample ID#. The BS key will allow you to backspace to remove a character that was incorrectly entered.
5. Touch enter to accept the current ID# and return to the pH (mV, Conductivity) Setup screen.



Sequential ID# Assignment

1. Access the Set Sample ID# screen from the pH (mV, Conductivity) Setup screen.

2. Touch seq for sequential ID# assignment. The current ID# is displayed on the screen.

3. Touch clear to delete the current ID#.

4. Use the alphanumeric keypad on the screen to enter the number that you would like your sequential ID# assignment to begin with. Every time you touch print on the Measure screen, the ID# will increase by 1. The BS key will allow you to backspace to remove a character that was incorrectly entered.

5. Touch enter to accept the first sequential ID# and return to the pH (mV, Conductivity) Setup screen.

OR

To Deactivate the Sample ID# Assignment

1. Access the Set Sample ID# screen from the pH (mV, Conductivity) Setup screen.

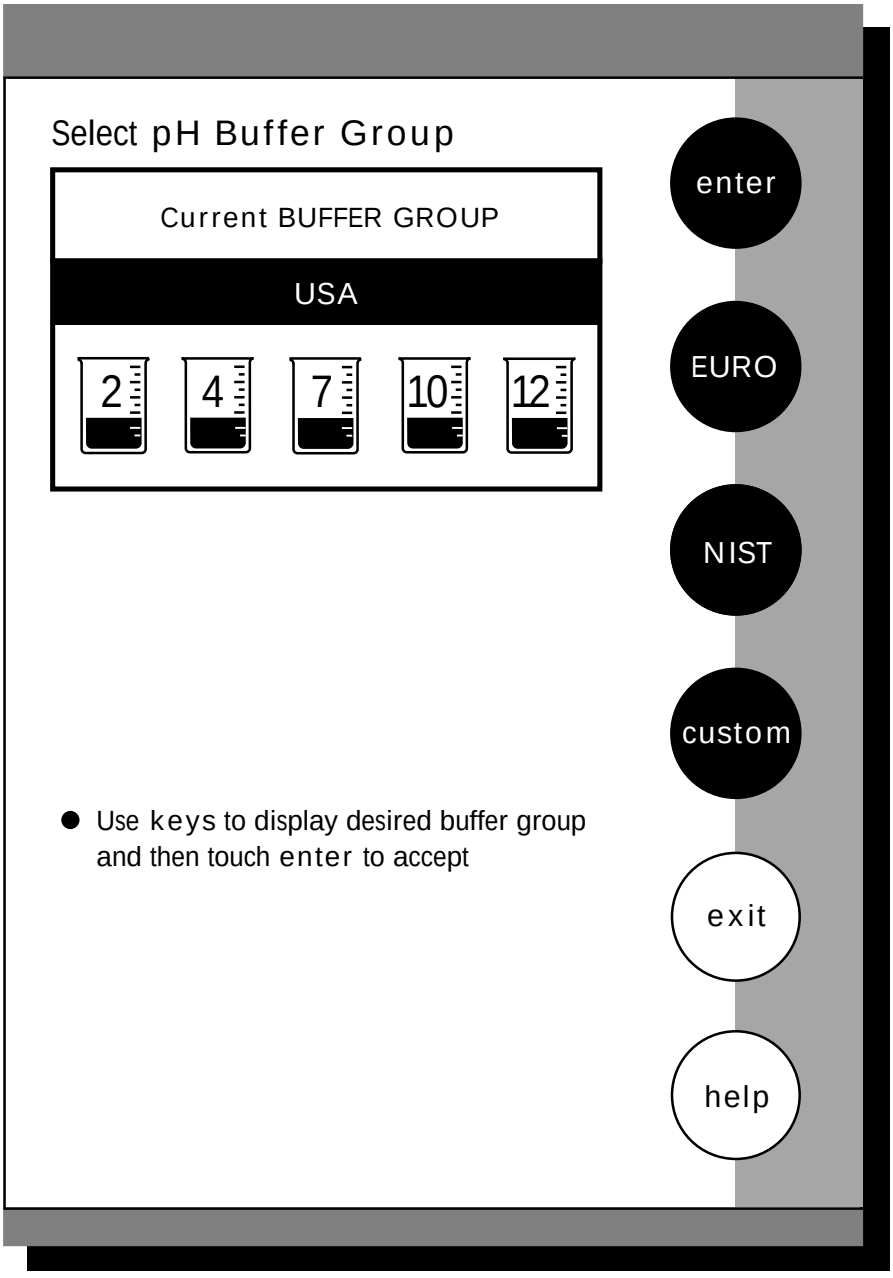
2. Touch man for manual ID# entry. The current ID# is displayed on the screen.

3. Touch clear to delete the current ID#.

4. Touch enter. The ID# assignment is now deactivated. No number will be assigned to your samples. The meter will return to the pH (mV, Conductivity) Setup screen.

OR

Touch exit to return to the pH (mV, Conductivity) Setup screen without making any changes.



Remember, HELP is always just a touch of the button away.

This setup option allows you to select from 3 different buffer groups, each containing 5 buffers, for auto buffer recognition. Or you can create a custom group of buffers for auto buffer recognition by touching custom.

The 3 existing buffer groups are:

USA buffers:	2, 4, 7, 10, and 12
European buffers:	1, 3, 6, 8, and 10
NIST buffers:	1.68, 4.01, 6.86, 9.18, and 12.45

To Select Buffer Group

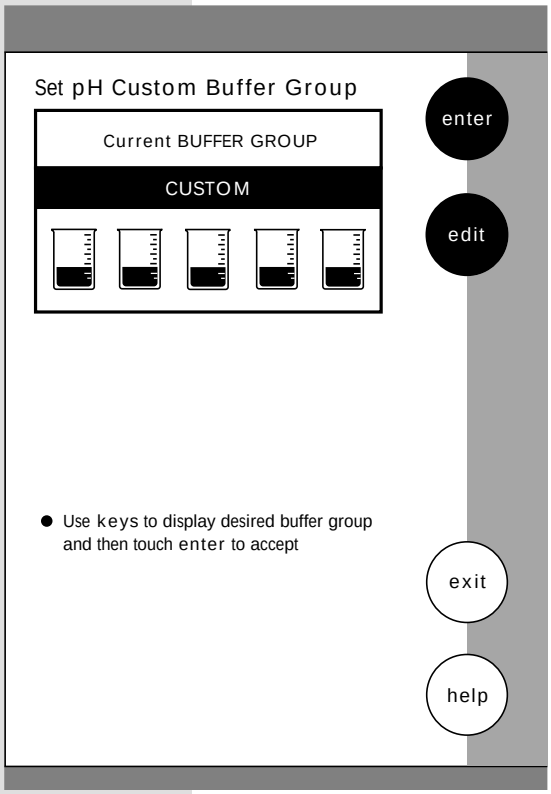
1. Access the Select pH Buffer Group screen from the pH Setup screen. The current buffer group is displayed on the screen.

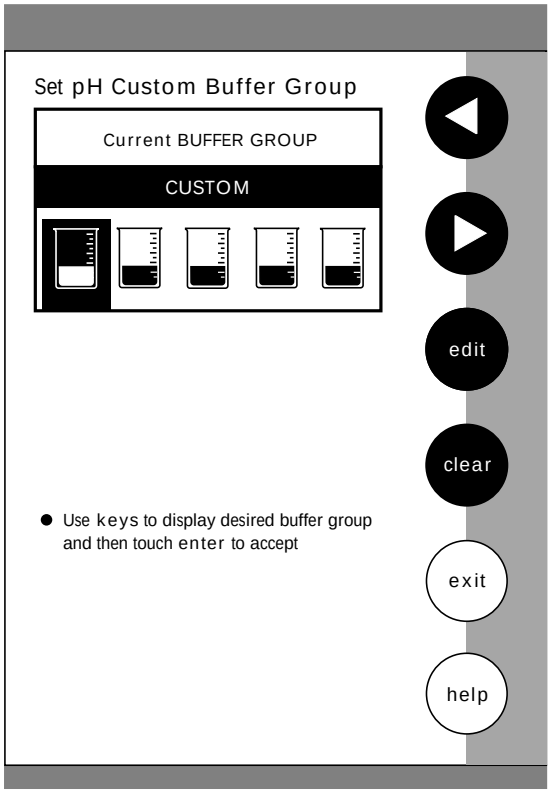
2. Touch USA or NIST or EURO or custom on the right of the screen to select a buffer group.

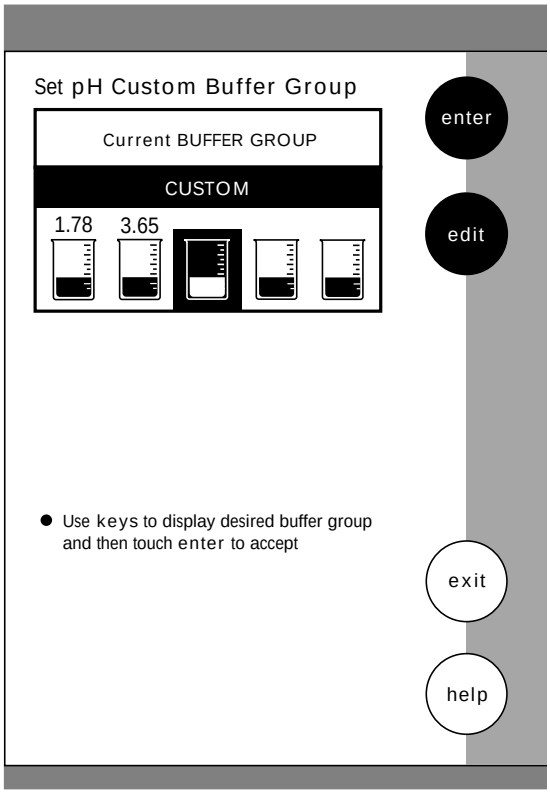
3. Touch enter to accept the buffer group to be used for auto recognition.

   OR

   Touch exit to return to pH Setup Screen, without making any changes.







To Set pH Custom Buffer Group

This option allows you to create a custom buffer group of up to 5 buffers to be used for auto buffer recognition. To obtain optimal results, it is important to maintain at least 2 pH units between selected buffers in the custom group.

1. Touch custom on the Set pH Buffer Group screen. The current buffer box will show the current custom buffer group.

2. Touch edit to alter the present group or create a new custom buffer group. The newly displayed Set pH Custom Buffer Group screen has 5 beakers in the current buffer group box.

3. Use the arrow keys to highlight the beaker icon with the pH value you want to change. If there are no buffers in the group then proceed to the next step.

4. Touch edit to add a buffer or make changes to the current buffer group OR touch clear to delete the highlighted buffer value.

5. Use the numeric keypad that is now displayed to enter the pH buffer value that you want in your custom buffer set.

6. Touch enter to accept the value. If you have entered an erroneous value, use the BS key on the keypad to erase the last digit entered and correct the mistake. If you decide not to change the buffer value on the highlighted beaker icon, touch exit on the numeric keypad to return to the Set pH Custom Buffer Group screen.

7. Repeat steps 3 through 6 to add up to 5 buffers to your custom buffer group.

8. Touch exit to return to the Set pH Custom Buffer Group screen to view the current Custom Buffer Group.

9. Touch enter to accept the group and return to the pH Setup screen, OR touch edit to modify the group and repeat steps 3 through 6.

   OR

   Touch exit to return to the Set pH Buffer Group screen, without making any changes to the custom buffer group.

If you use the custom buffer group for auto buffer recognition, when you access the Set pH Buffer Group from the pH Setup screen, the current buffer group that appears on the screen is the custom buffer group. In order to access the edit option for the custom buffer group, you need to touch any of the other buffer group buttons and then touch custom to access the edit screen.

This option allows you to select Automatic buffer recognition or manual buffer recognition when standardizing. With the Automatic buffer recognition activated, the meter will automatically recognize the buffers from the chosen buffer group and accept them when the meter recognizes the reading as stable. When in the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will accept the manually entered buffer when it recognizes that the measurement is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching std.

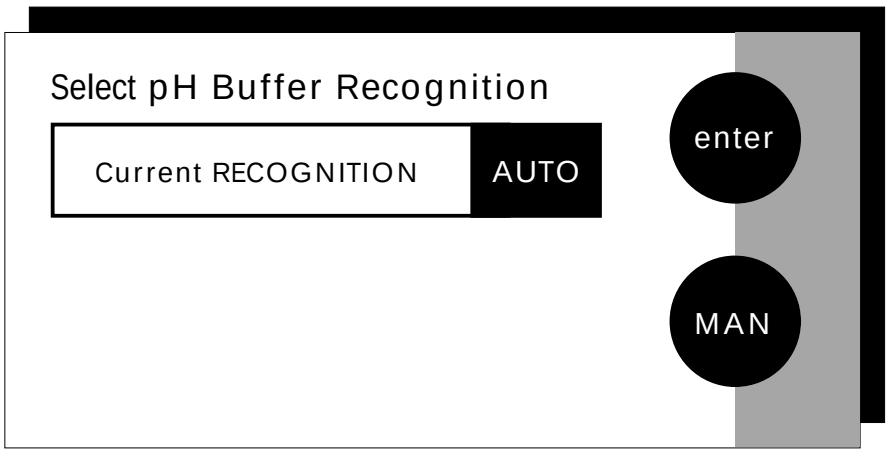
Regardless of which Buffer Recognition Mode you select, STABLE will appear on the Measure screen when the meter recognizes the value as stable.

To Select Buffer Recognition

1. Access the Select Buffer Recognition screen from the pH Setup screen. The current method of recognition is displayed on the screen.
2. Touch MAN or AUTO to choose the method of buffer selection.
3. Touch enter to accept the method of buffer recognition and return to the pH Setup screen.

   OR

   Touch exit to return to the pH Setup screen, without making any changes.



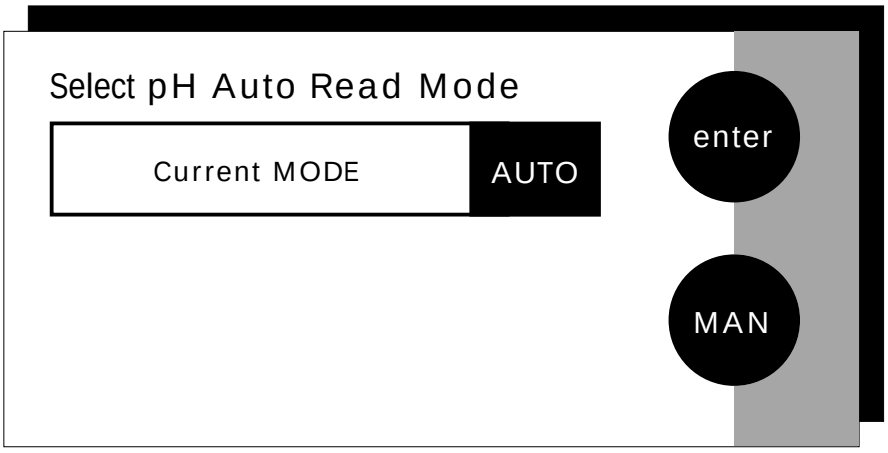
You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until meas is touched. If the Auto Read function is inactive, then the meter will continuously monitor the pH of the sample and the Measure screen display will indicate any fluctuation in the sample pH.

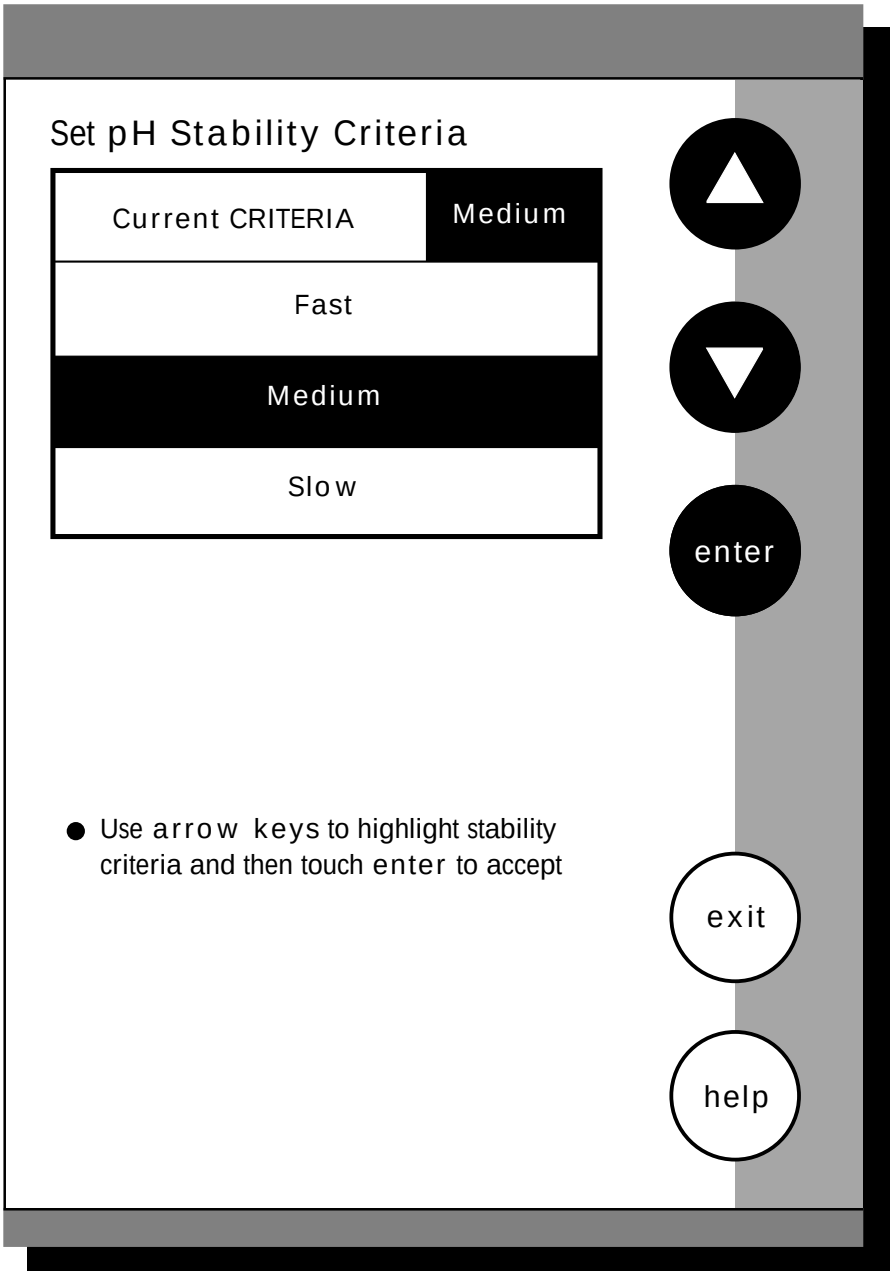
To Select Auto Read Mode

1. Access the Select Auto Read Mode screen from the pH Setup screen. The current Read Mode is displayed on the screen.
2. Touch AUTO or MAN to choose the desired read mode.
3. Touch enter to accept the read mode and return to the pH Setup screen.

   OR

   Touch exit to return to the pH Setup Screen, without making any changes.





This setup screen allows you to determine how quickly the meter will respond to electrode drift. There are 3 speed settings: fast, medium and slow.

To Set pH Stability Criteria

1. Access the Set pH Stability Criteria screen from the pH Setup screen. The current stability criteria are displayed on the screen.

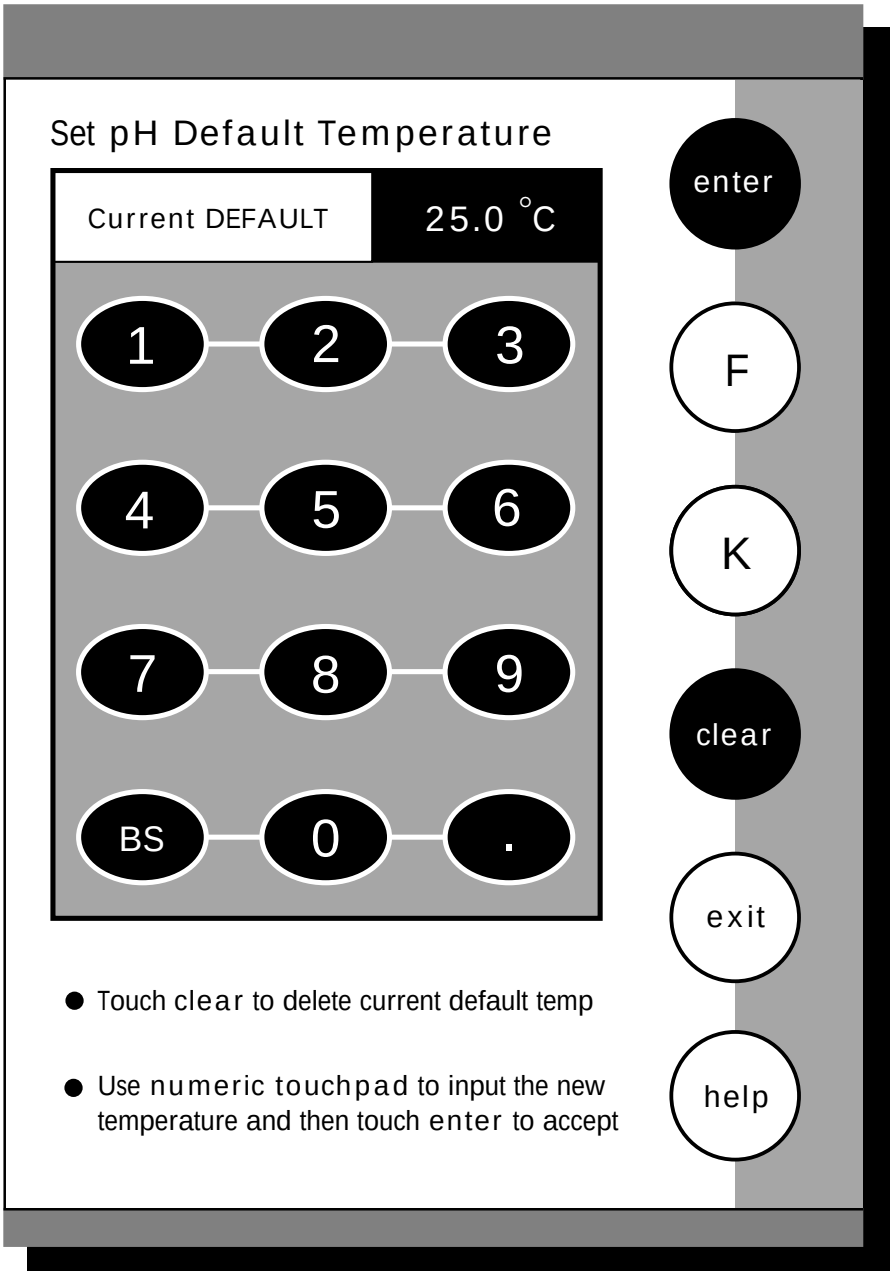
2. Use the arrow keys to highlight the desired stability criteria.

3. Touch enter to accept the stability criteria and return to the pH Setup screen.

   OR

   Touch exit to return to the pH Setup screen, without making any changes.

Stability criteria are more stringent at the slower setting. Therefore, if the highest precision is required, then a slow setting would be desired. The default setting is the medium speed and this should be adequate for the majority of applications.



It is a well known fact that pH is a temperature dependent measurement. The factory default setting is 25°C. If you are taking the pH of a solution that is not 25°C and you are not using an Automatic Temperature Compensation (ATC) Probe, then you should enter the temperature value of that solution in order to get the correct pH value. The current default temperature setting will be displayed when the Set Default Temperature screen is displayed.

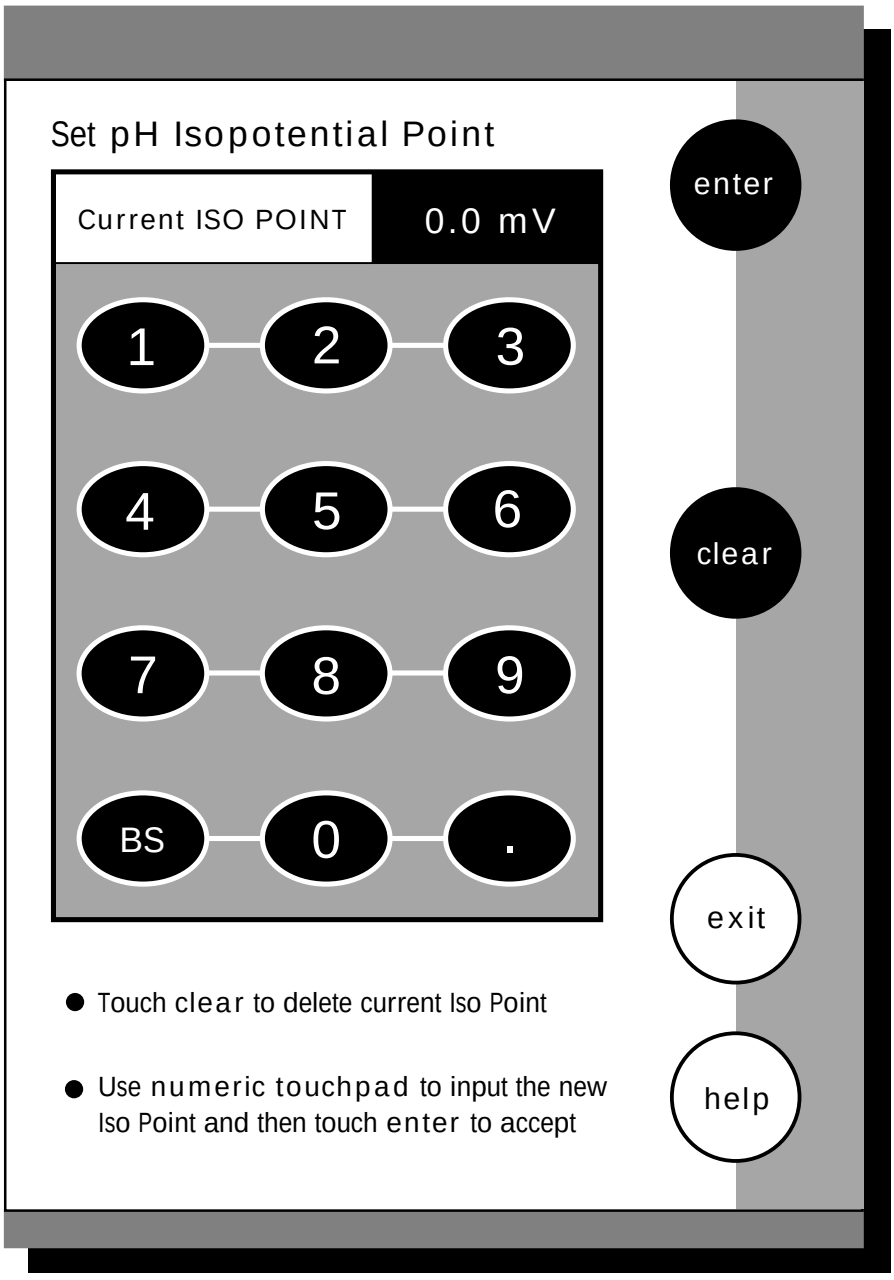
To Set Default Temperature

1. Access the Set Default Temperature screen from the pH (Conductivity) Setup screen. The current default temperature is displayed on the screen.
2. Touch clear to erase the current temperature value.
3. Select the temperature units by touching the appropriate unit key C (Celsius), F (Fahrenheit), or K (Kelvin).
4. Use the numeric keypad to enter the desired default temperature.
5. Touch enter to accept the temperature setting and return to the pH (Conductivity) Setup screen.

   OR

   Touch exit to return to the pH (Conductivity) Setup screen, without making any changes.

The use of an ATC probe provides a measured temperature value to the meter and will override any value entered in the default temperature screen. This measured value will be used by the meter to make pH (Conductivity) calculations.



The Isopotential Point is the millivolt reading for an electrode at which temperature has no effect on the measurement. pH electrodes are constructed so that the isopotential point is theoretically zero millivolts. This is very close to a pH of 7. Most pH electrodes do not achieve this value precisely. However, they are close enough so that it is not usually necessary to use an isopotential point other than zero. The true isopotential point of any given electrode must be determined experimentally. (See Appendix: Determining Isopotential Points Experimentally, page 129)

To Set Isopotential Point

1. Access the Set Isopotential Point screen from the pH Setup screen. The current isopotential point is displayed on the screen.

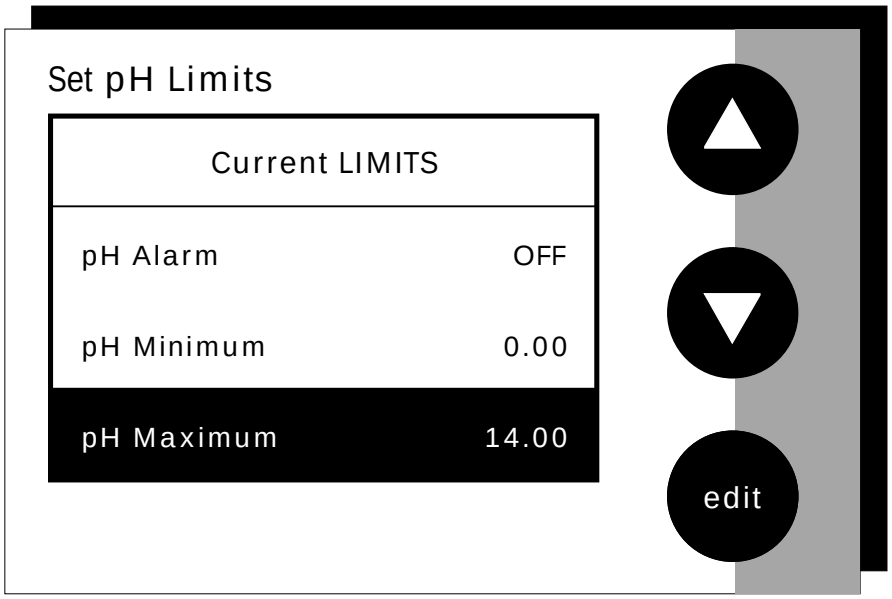
2. Touch clear to remove the current mV value.

3. Use the numeric keypad to enter the desired mV setting for the new isopotential point.

4. Touch enter to accept this value and return to the pH Setup screen.

   OR

   Touch exit to return to the pH Setup screen, without making any changes.



Set mV Limits

Current LIMITS	
- mV Alarm	OFF
- mV Minimum	-1800.0
- mV Maximum	1800.0

Set Cond Limits

Current LIMITS	
- Conductivity Alarm	OFF
- Conductivity Minimum	0.00
- Conductivity Maximum	1.00E6

This option allows you to set alarm limits for the pH measuring mode. If the pH value of the measurement is outside of the boundaries set by the minimum and maximum limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

To Set Alarm Limits

1. Access the Set Alarm Limits screen from the pH (mV, Conductivity) Setup screen. The current alarm limits are displayed on the screen.
2. Use the arrow keys to highlight the pH (mV, Conductivity) Alarm option you want to modify.
3. Touch ON or OFF to set the status of the alarm for the pH (mV, Conductivity) mode.
4. Use the arrow keys to highlight the desired pH (mV, Conductivity) alarm limit.
5. Touch edit to change the value.
6. Use the keypad to enter the new limit value.
7. Touch enter on the keypad to accept this limit and return to the Set pH (mV, Conductivity) Limits screen. If you do not want to change the limit value, you can touch exit on the keypad and return to the Set pH (mV, Conductivity) Limits screen.
8. Repeat steps 4 through 7 to set the other pH (mV, Conductivity) Alarm limit.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

Set pH Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- pH measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Buffers	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON

Set mV Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- mV measurement	ON
- Temperature - ATC	ON
- Meter model #/serial #	ON
- Operator	ON

Set Cond Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- Conductivity measurement	ON
- Temperature - ATC	ON
- Reference Temperature	ON
- Temperature Coefficient	ON
- Last Standardization	OFF
- Current Standard	OFF
- Cell Constant	ON
- Meter model #/serial #	ON
- Operator	ON

This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

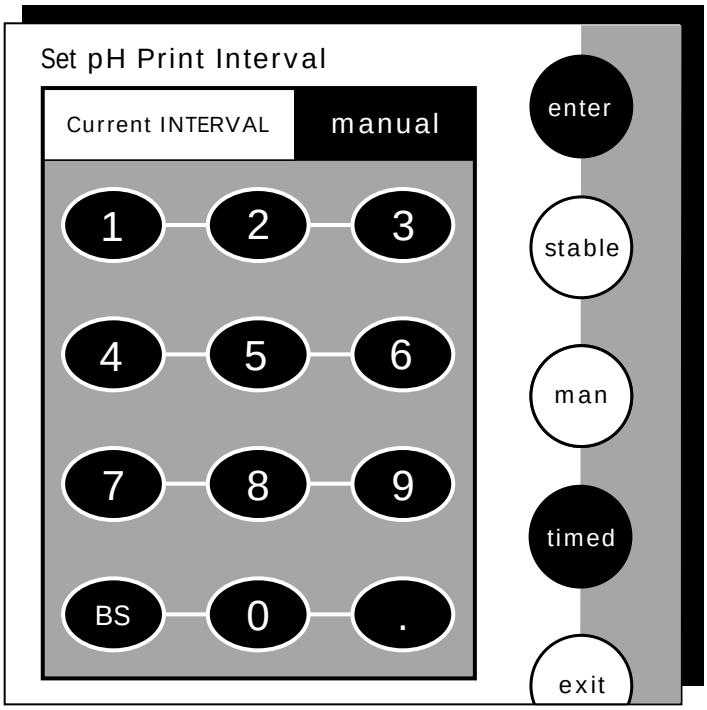
To Set Print Criteria

1. Access the Set Print Criteria screen from the pH (mV, Conductivity) Setup screen. The current print criteria are displayed on the screen.
2. Use the arrow keys to highlight the print criteria option you want to modify.
3. Touch ON or OFF change the status of the criteria.
4. Repeat steps 2 and 3 with the remaining criteria.
5. Touch save to save the entire group of print criteria and return to the pH (mV, Conductivity) Setup screen.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

The Date/Time/Channel option and the Measurement option are always active and cannot be deactivated. These criteria will always be printed. Because they can not be changed, they will not be highlighted when using the arrow keys.



You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

For manual printing of data

In this mode, data is printed only when you touch print on the pH (mV, Conductivity) Measure screen.

1. Access the Set Print Interval screen from the pH (mV, Conductivity) Setup screen. The current print interval is displayed on the screen.

2. Touch MAN to set the meter for manual printing.

3. Touch enter to accept the print interval mode and return to the pH (mV, Ion, Conductivity) Setup screen.

   Printing is now done manually by touching print on the Measure screen.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

For stable reading printing

In this mode, data is printed every time the meter recognizes the current pH (mV, Conductivity) measurement as stable.

1. Access the Set Print Interval screen from the pH (mV, Conductivity) Setup screen. The current print interval is displayed on the screen.

2. Touch stable to set the meter for stable reading printing.

3. Touch enter to accept the print interval mode and return to the pH (mV, Conductivity) Setup screen.

   Printing is now done when the meter recognizes the present reading as stable.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

For timed interval printing

In this mode, data is printed at the timed interval that you select.

1. Access the Set Print Interval screen from the pH (mV, Conductivity) Setup screen. The current print interval is displayed on the screen.

2. Touch timed to access the timed interval mode and delete the current print interval time.

3. Use the keypad to enter the desired time for the print interval.

4. Touch enter to accept the new time interval for printing and return to the pH (mV, Conductivity) Setup screen.

   Printing is now done at the set timed interval.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

Set pH Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- pH measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Buffers	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON

Set mV Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- mV measurement	ON
- Temperature - ATC	ON
- Meter model #/serial #	ON
- Operator	ON

Set Cond Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- Conductivity measurement	ON
- Temperature - ATC	ON
- Reference Temperature	ON
- Temperature Coefficient	ON
- Last Standardization	OFF
- Current Standards	OFF
- Cell Constant	ON
- Meter model #/serial #	ON
- Operator	ON

This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. Data is stored only if a Sample ID# has been assigned. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed with the previously stored data.

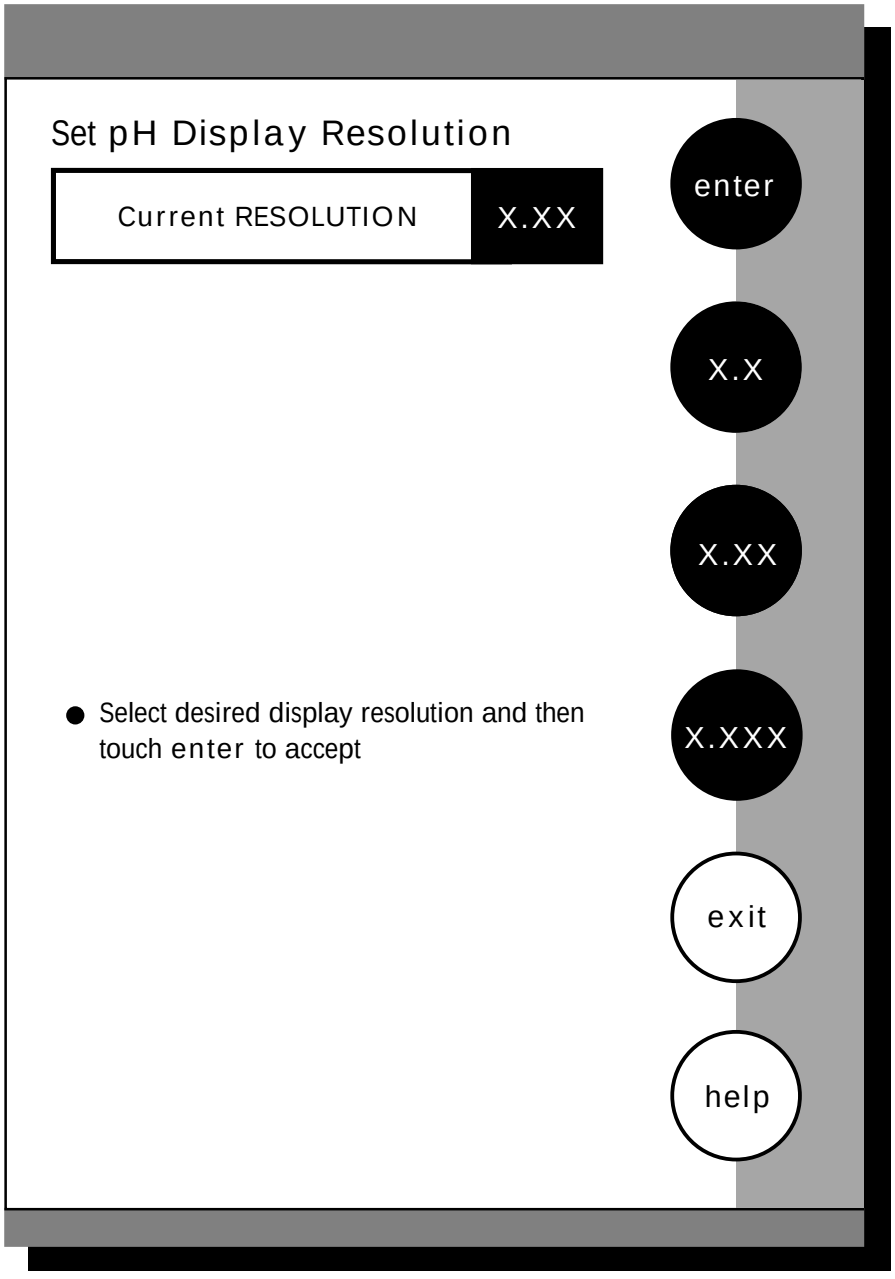
To Set Data Storage Criteria

1. Access the Set Data Storage Criteria screen from the pH (mV, Conductivity) Setup screen. The current Data Storage Criteria are displayed on the screen.
2. Use the arrow keys to highlight the data storage criteria you want to modify.
3. Touch ON or OFF to change the status of the criteria.
4. Repeat steps 2 and 3 with the remaining criteria.
5. Touch save to save the entire group of data storage criteria and return to the pH (mV, Conductivity) Setup screen.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

The Date/Time/Channel criteria and the Measurement criteria are always active and cannot be deactivated. These criteria will always be stored with the measurement value. Because they can not be changed, they will not be highlighted when using the arrow keys.



This mode allows you to set the display resolution that you desire on the screen. You have the choice of one, two or three decimal places.

To Set Display Resolution

1. Access the Set Display Resolution screen from the pH Setup screen. The current Display Resolution is displayed on the screen.

2. Touch X.X, X.XX or X.XXX to select the desired resolution of the display. This will be the format in which your measurement will be displayed.

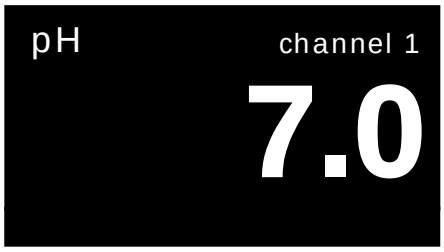
3. Touch enter to accept the resolution and return to the pH Setup screen.

   OR

   Touch exit to return to the pH Setup screen, without making any changes.

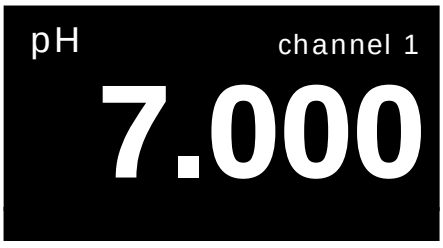
Remember, HELP is always just a touch of the button away.

Example of X.X resolution



Example of X.XX resolution

Example of X.XXX resolution



Set pH Display Configuration

Current DISPLAY CONFIGURATION	
- Last Standardization	ON
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- auto buffer status	ON
- auto read status	ON
- temperature	ON
- slope	ON
- mV Display	ON

Set mV Display Configuration

Current DISPLAY CONFIGURATION	
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- temperature	ON

Set Cond Display Configuration

Current DISPLAY CONFIGURATION	
- Last Standardization	ON
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- Cell Constant	ON
- temperature	ON
- reference temperature	ON
- temperature coefficient	ON

This function will allow you to choose what information you would like to be displayed on the pH Measure screen, particularly the information contained in the data box at the bottom of that screen.

To Set Display Configuration

1. Access the Set Display Configuration screen from the pH (mV, Conductivity) Setup screen. The current Display Configuration is displayed on the screen.

2. Use the arrow keys to highlight the Display Configuration criteria you want to modify.

3. Touch ON or OFF to change the status of the criteria.

4. Repeat steps 2 and 3 with the remaining criteria.

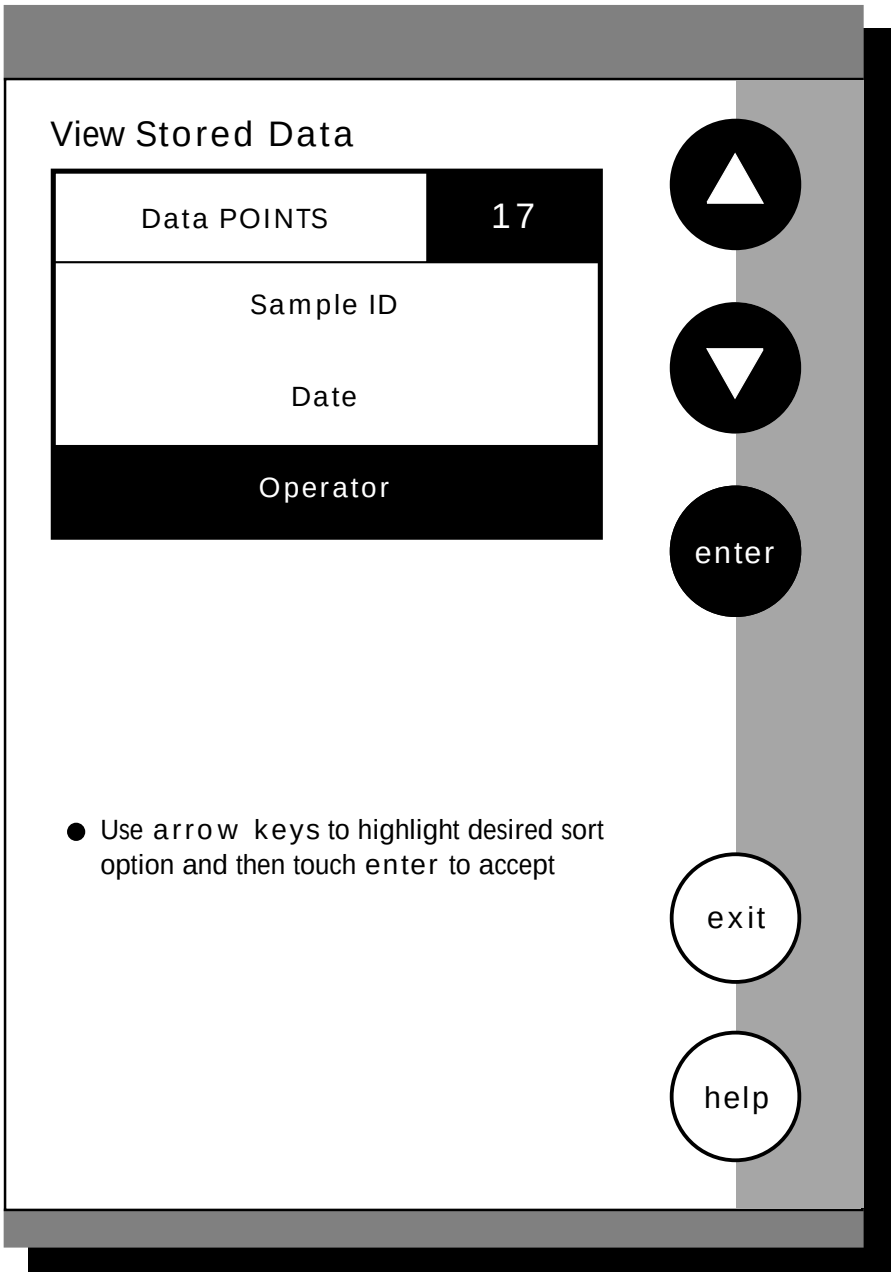
5. Touch save to save the entire group of Display Configuration criteria and return to the pH (mV, Conductivity) Setup screen.

   OR

   Touch exit to return to the pH (mV, Conductivity) Setup screen, without making any changes.

pH Display Configuration

September 17, 1997			11:11 am
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0



This pH meter has memory capacity of up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

To View Stored Data

1. Access the View Stored Data screen from the pH (mV, Conductivity) Setup screen. The number of data points in the memory and the sorting options are now displayed on the screen.
2. Use the arrow keys to highlight the desired data sort option.
3. Touch enter to access the sort option screen.

To sort by Sample ID#

1. Access the Sample ID sort option from the View Stored Data screen.
2. Use the keypad to enter the sample ID# of the data point(s) that you want to view.
3. Touch clear to delete a Sample ID# entered in error and reenter the ID#.
4. Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Sample ID#.
5. Touch next or prev to scroll through additional data points saved in the memory of the meter.
6. Touch print to send the data to a printer or computer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Conductivity) Setup screen.

If a sample ID# is entered and no data points are stored with that sample ID#, you will see a message indicating the sample ID# was not found. Touch OK to return to the sample ID# keypad and enter a new sample ID#.

To sort by Date

1. Access the Date sort option from the View Stored Data screen.
2. Touch clear to delete the current date.
3. Use the numeric keypad to enter the date on which the data points you want to view were saved. Be sure to use / to separate the month, the day and the year.
4. Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Date.
5. Touch next or prev to scroll through additional data points saved in the memory of the meter.
6. Touch print to send the data to a printer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Conductivity) Setup screen.

If a date is entered and no data points are stored with that date, you will see a message indicating the date was not found. Touch OK to return to the operator ID keypad and enter a new date.

To sort by Operator

1. Access the Operator sort option from the View Stored Data screen.
2. Use the keypad to enter the Operator ID of the data point(s) that you want to view.
3. Touch clear to delete an Operator ID entered in error and reenter an ID#.
4. Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Operator ID.
5. Touch next or prev to scroll through additional data points saved in the memory of the meter.
6. Touch print to send the data to a printer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Conductivity) Setup screen.

If an operator ID is entered and no data points are stored with that operator ID, you will see a message indicating the operator ID was not found. Touch OK to return to the operator ID keypad and enter a new operator ID.

NOTE:
Even if you do not know the appropriate information to access a specific data point, you can access the stored data through any of the sort options. Highlight the sort option of interest and touch enter to access the sort screen. Touch enter again and the meter will place you at a data point.

* The sample ID# sort option will place you at the first data point in numeric order by sample ID#.

* The Operator sort option will place you at the data point of the first operator ID in alphabetic order.

* The Date sort option will place you at the most recent point on the last date that data was stored.

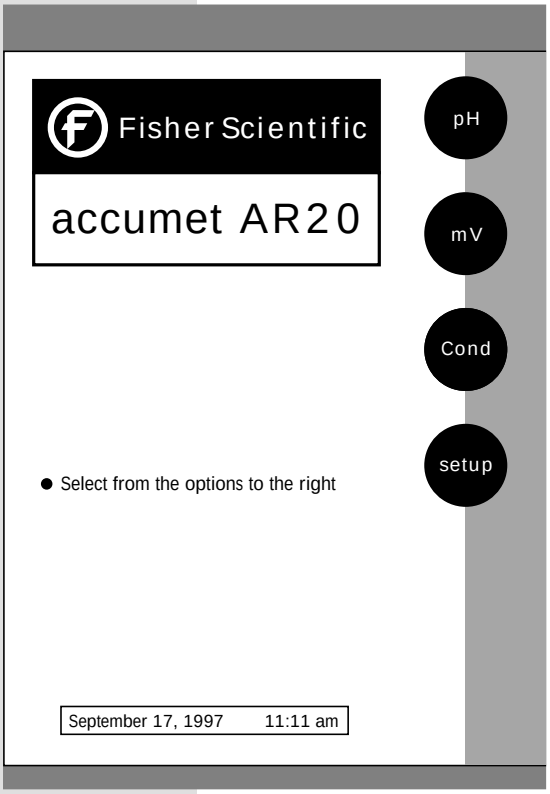
Once you access the data storage center, you can touch prev and next to scroll through the additional data points stored in memory.

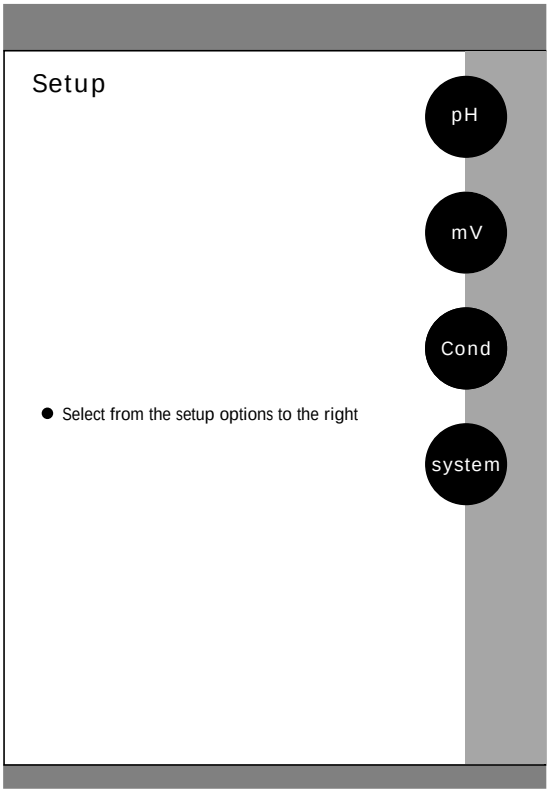
View Stored Data

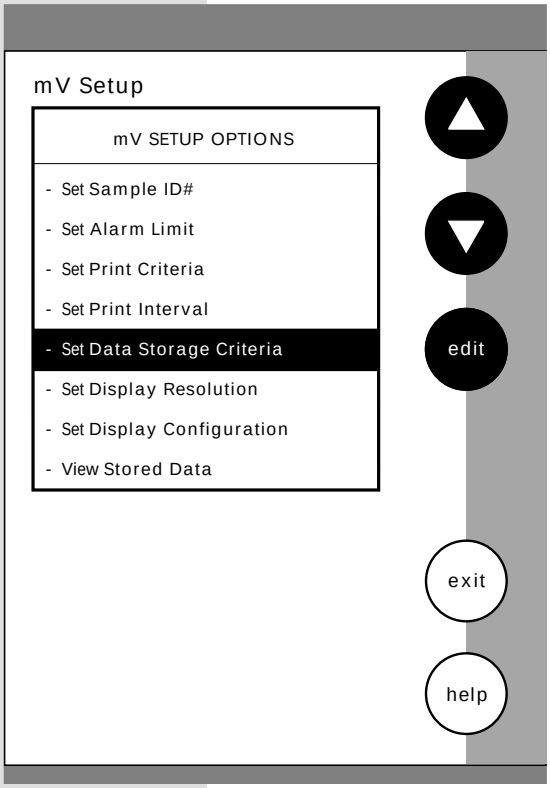
Current STORED DATA	
September 17, 1997 11:11 am	
sample ID#:	110
pH value:	9.25
Temperature:	25.0°C
Last Std:	Sep.17 @11:11am
Current Stds:	4.0, 7.0, 10.0
Slope:	100.2%
mV value:	0.6
model#/serial#:	AR15/alpha 0001
Operator:	Tom D.


accumet®
RESEARCH
mV Setup
mV SETUP OPTIONS
- Set Sample ID#
- Set Alarm Limit
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Display Resolution
- Set Display Configuration
- View Stored Data
edit
exit
help
Fisher Scientific

The operating parameters of the mV mode can be set and controlled from the mV Setup screen. The following sections will guide you through the various options available for the mV setup mode.







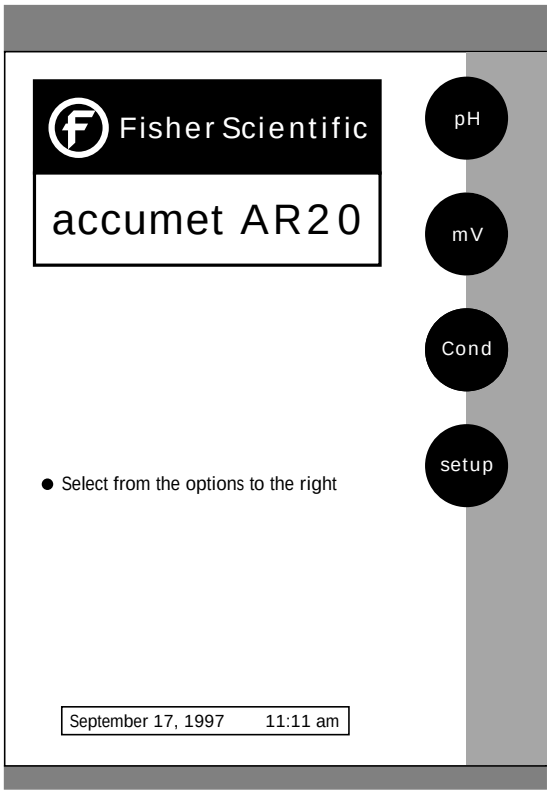
There are two ways to access the mV Setup screen.

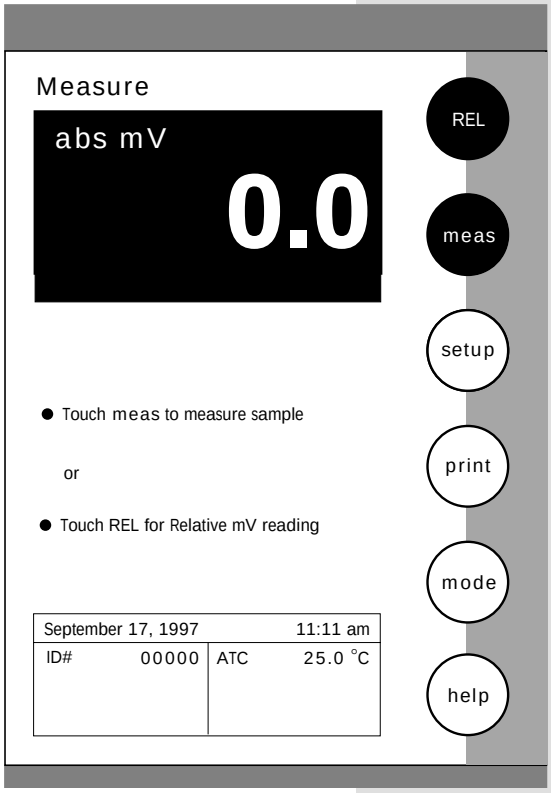
From the Setup screen

1 Touch setup on the main screen. Touch mV to access the mV Setup screen.

2 Use the arrow keys to highlight the setup option that you would like to review.

3 Touch edit to access the screen for the selected option.



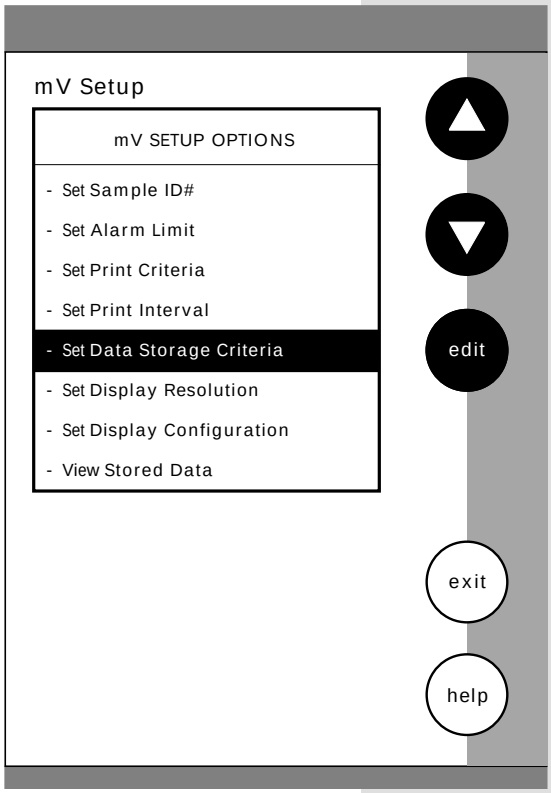


From the mV Measure screen

1 Touch mV on the main screen to access the millivolt mode. Touch setup on the mV Measure screen. The mV Setup screen is now displayed.

2 Use the arrow keys to highlight the setup option that you would like to review.

3 Touch edit to access the screen for the selected option.



To Set Sample ID#

When this option is active, each time you touch print on the Measure screen the mV value along with the date/time/channel and the sample ID# will be sent to data storage. You can manually enter an alphanumeric identification number of up to 10 characters for any sample, or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

The mV Sample ID# is set the same way as previously described in pH Setup. See page 48 for instructions.

To Set Alarm Limit

This option allows you to set alarm limits for the mV measuring mode. If the mV value of the measurement is outside of the boundaries set by the upper and lower limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The mV Alarm Limits are set the same way as previously described in pH Setup. See page 64 for instructions.

Remember, HELP is always just a touch of the button away.

To Set Print Criteria

This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

The mV Print Criteria are set the same way as previously described in pH Setup. See page 66 for instructions.

To Set Print Interval

You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

The mV Print Interval is set the same way as previously described in pH Setup. See page 68 for instructions.

To Set Data Storage Criteria

This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed with the previously stored data.

The mV Data Storage Criteria are set the same way as previously described in pH Setup. See page 85 for instructions.

To Set Display Configuration

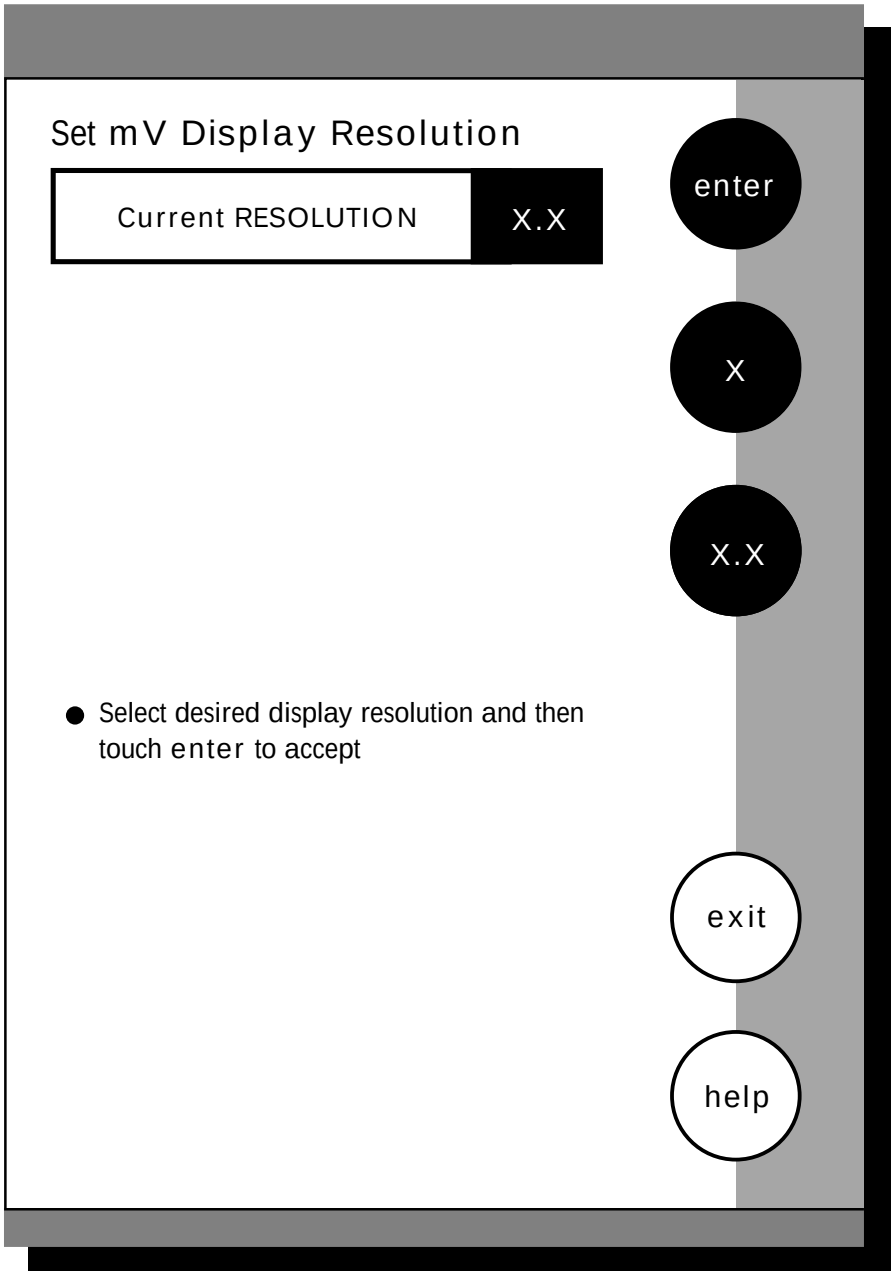
This function will allow you to choose what information you would like to be displayed on the mV Measure screen, particularly the information contained in the data box at the bottom of that screen.

The mV Display Configuration is set the same way as previously described in pH Setup. See page 85 for instructions

To View Stored Data

This meter has memory capacity for up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

The mV Stored Data is viewed the same way as previously described in pH Setup. See page 85 for instructions.



To Set Display Resolution

This mode allows you to set the display resolution that you desire on the screen. You have the choice of zero or one decimal place.

1. Access the Set Display Resolution screen from the mV Setup screen. The current Display Resolution is displayed on the screen.

2. Touch X or X.X to select the resolution of the display that you desire. This will be the format in which your measurement will be displayed.

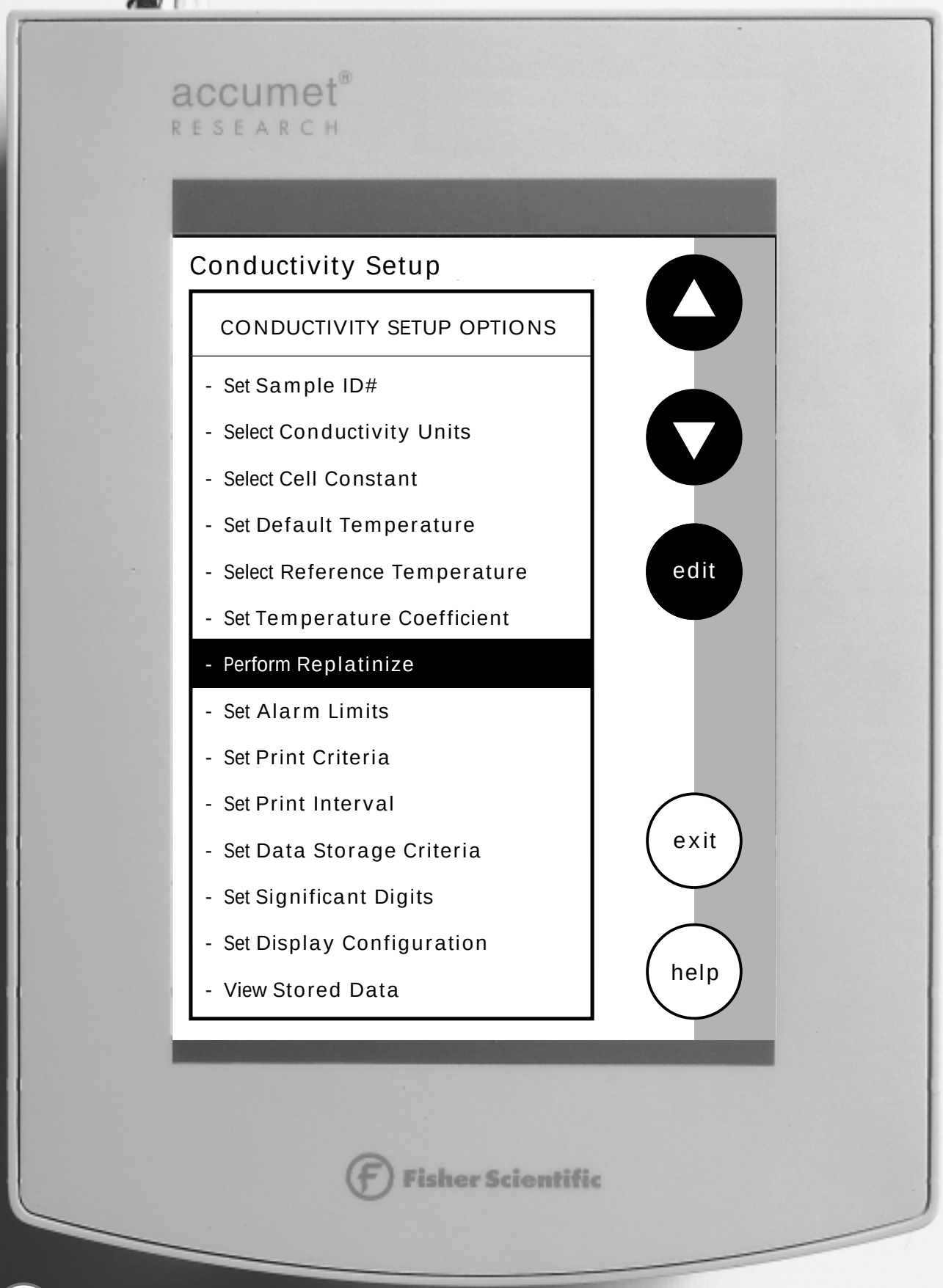
3. Touch enter to accept the resolution and return to the mV setup screen.

   OR

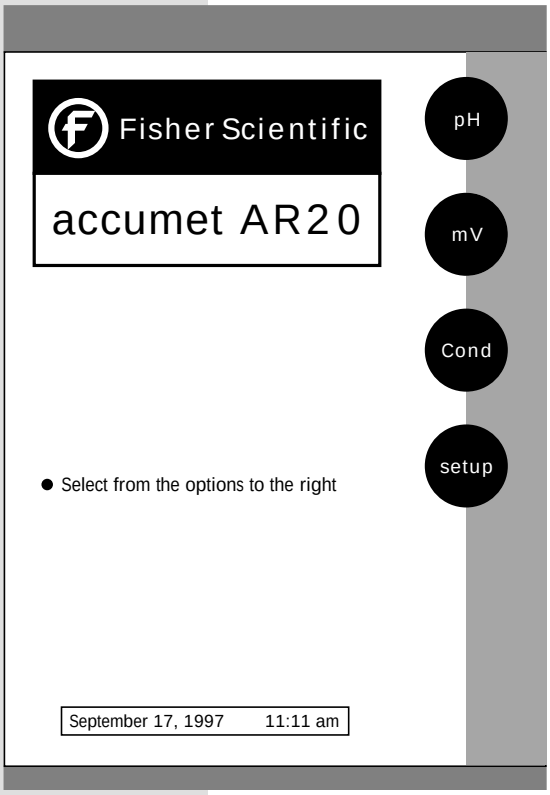
   Touch exit to return to the mV Setup Screen, without making any changes.

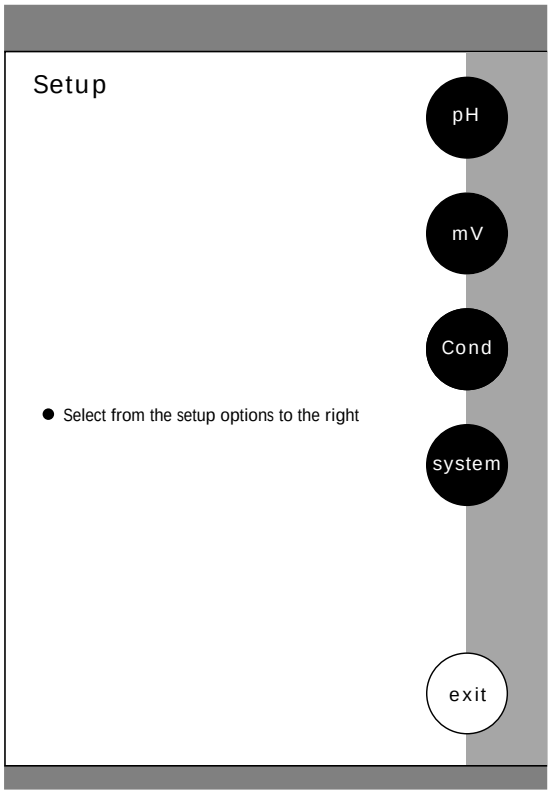
Example of X resolution

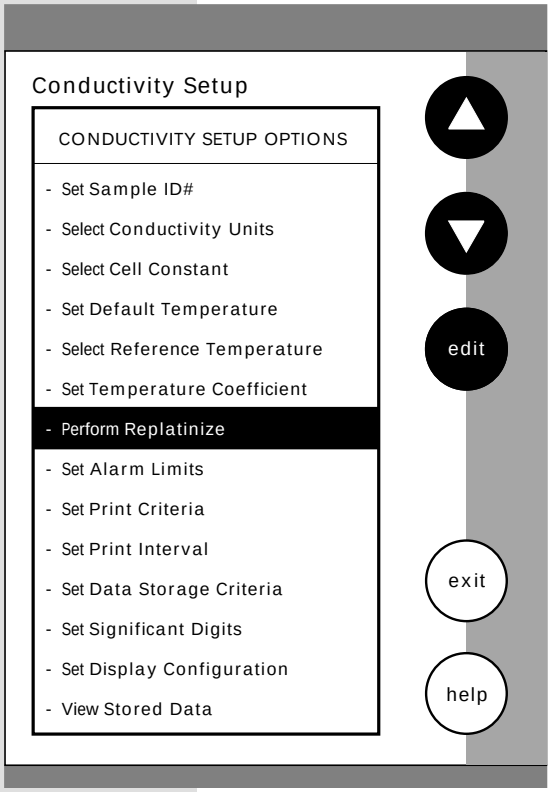
Example of X.X resolution


accumet®
RESEARCH
Conductivity Setup
CONDUCTIVITY SETUP OPTIONS
- Set Sample ID#
- Select Conductivity Units
- Select Cell Constant
- Set Default Temperature
- Select Reference Temperature
- Set Temperature Coefficient
- Perform Replatinize
- Set Alarm Limits
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Significant Digits
- Set Display Configuration
- View Stored Data
edit
exit
help
Fisher Scientific

The operating parameters of the conductivity mode can be set and controlled from the Conductivity Setup screen. The following sections will guide you through the various options available for the conductivity setup mode.



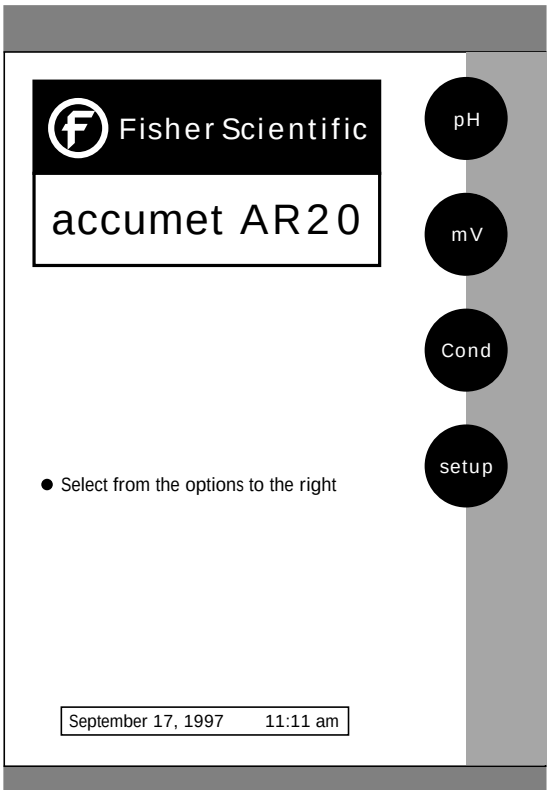


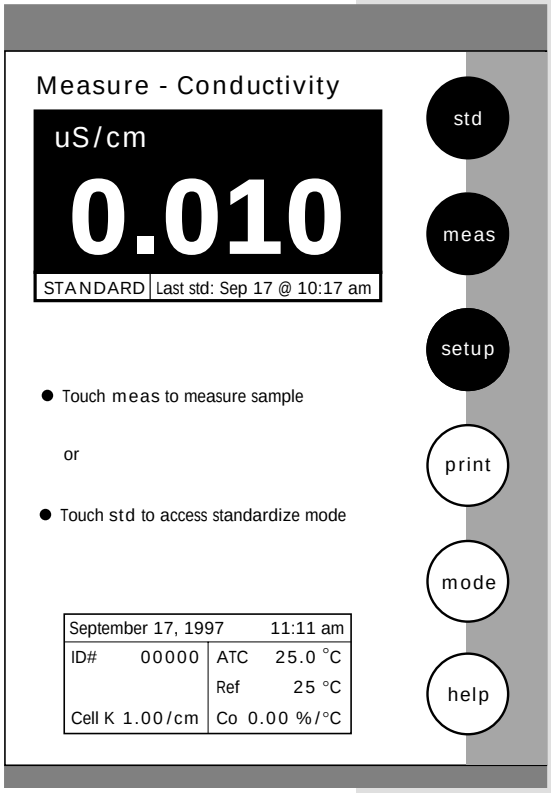


There are two ways to access the Conductivity Setup screen.

From the Setup screen

1. Touch setup on the main screen. Then touch Cond to access the Conductivity Setup screen.
2. Use the arrow keys to highlight the setup option that you would like to review.
3. Touch edit to access the screen for the selected option.



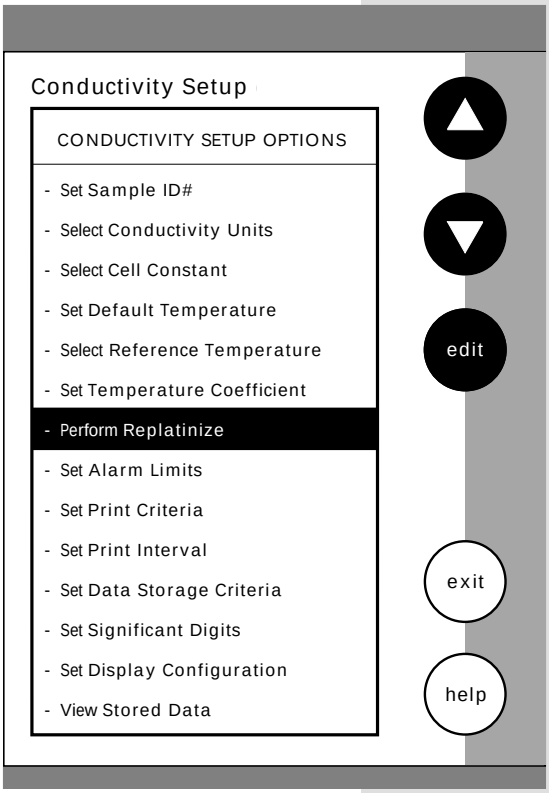


From the Conductivity Measure screen

1 Touch Cond on the main screen to access the conductivity mode. Touch setup on the Conductivity Measure screen. The conductivity setup screen is now displayed.

2 Use the arrow keys to highlight the setup option that you would like to review.

3 Touch edit to access the screen for the selected option.



To Set Sample ID#

When this option is active, each time you touch print on the Measure screen the Conductivity value along with the date/time/channel and the sample ID# will be sent to data storage. You can manually enter an alphanumeric identification number of up to 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

The Conductivity Sample ID# is set the same way as previously described in pH Setup. See page 48 for instructions.

To Select Conductivity Units

This screen allows you to select the units in which the meter will report the conductivity measurement of your sample. You can choose microSiemens/cm for conductivity or, ppt for Salinity or, ppm for total dissolved solids or, ohm•cm for resistivity. The current units are displayed on the screen.

The salinity scale is a measure of all salts, not just sodium chloride in seawater.

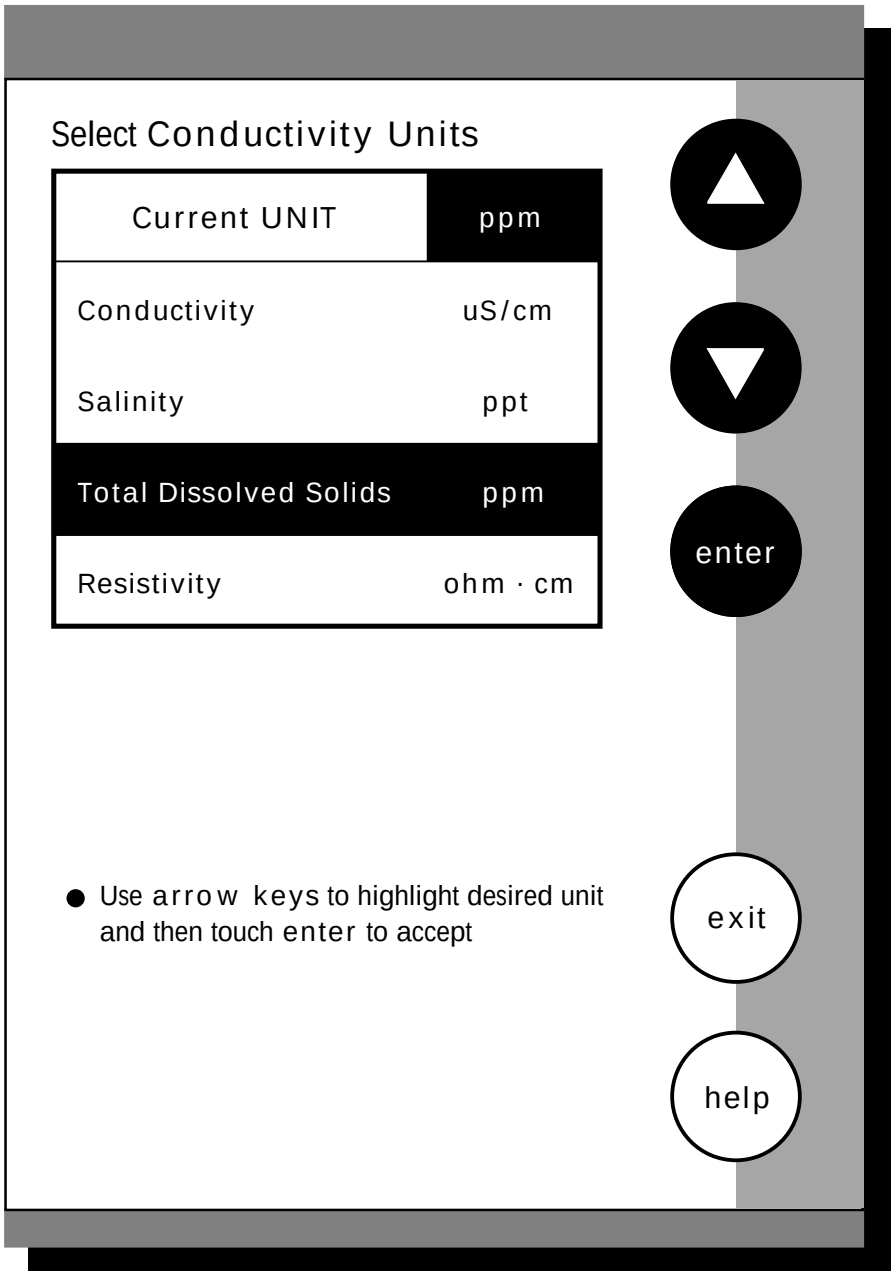
1. Access the Select Conductivity Units from the Conductivity Setup screen. The current units are displayed on the screen.

2. Use the arrow keys to highlight the desired units.

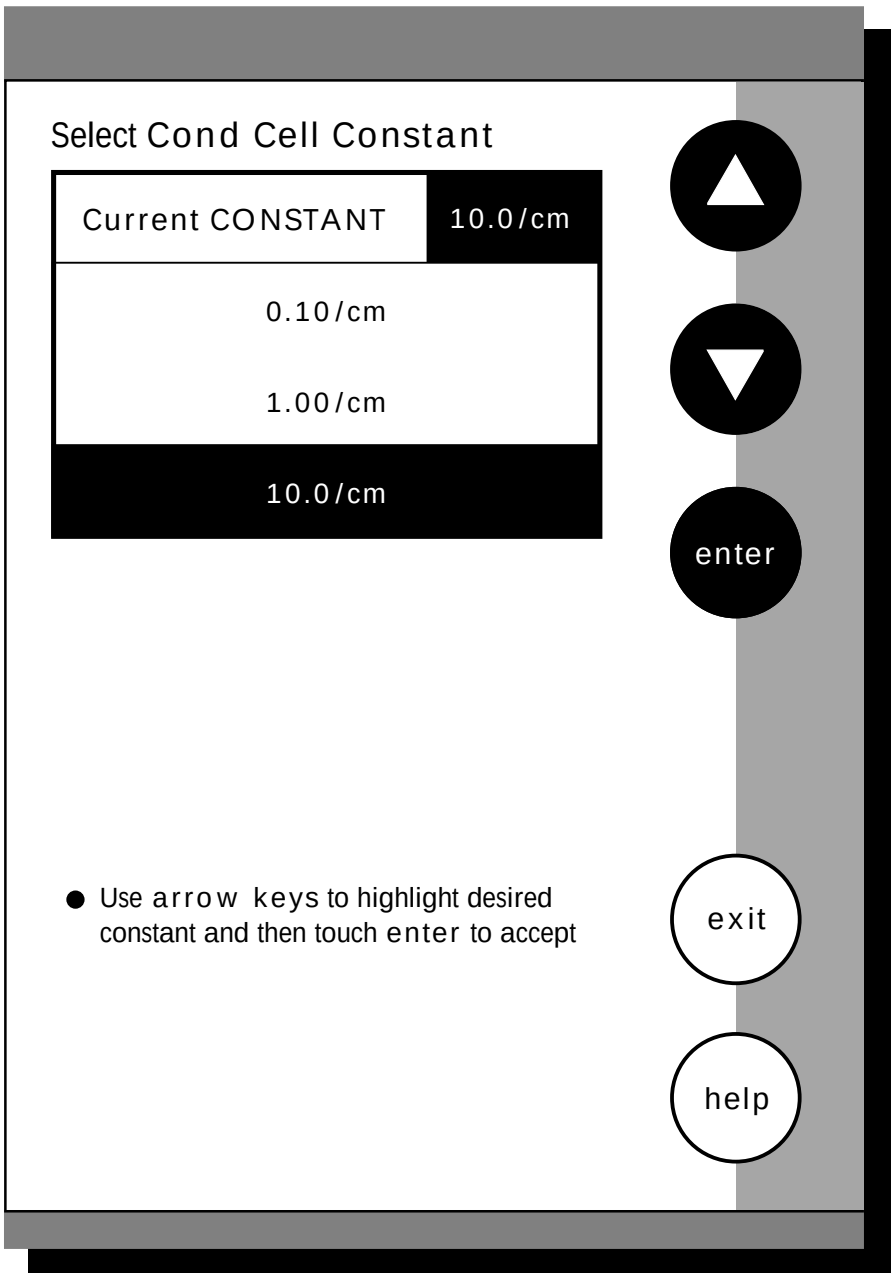
3. Touch enter to accept these units and return to the Conductivity Setup screen.

   OR

   Touch exit to return to the Conductivity Setup screen, without making any changes.



- Use arrow keys to highlight desired unit and then touch enter to accept



Remember, HELP is always just a touch of the button away.

This screen allows you to select the appropriate cell constant of the conductivity cell that you are using. There are three cell constants to choose from. Each is used for a different range of conductivity. The following indicates the optimal conductivity range for the accumet conductivity cells.

	Optimal Conductivity Range	
Cell Constant	2-cell	4-cell
0.1	0.5 to 200 µS/cm	Not Available
1.0	0.01 to 2 mS/cm	0.01 to 20 mS/cm
10.0	1 to 200 mS/cm	1 to 200 mS/cm

To Select Cell Constant

1. Access the Select Cell Constant screen from the Conductivity Setup screen. The current cell constant is displayed on the screen.

2. Use the arrow keys to highlight the cell constant that corresponds to the cell constant of your conductivity probe.

3. Touch enter to accept the cell constant and return to the Conductivity Setup screen.

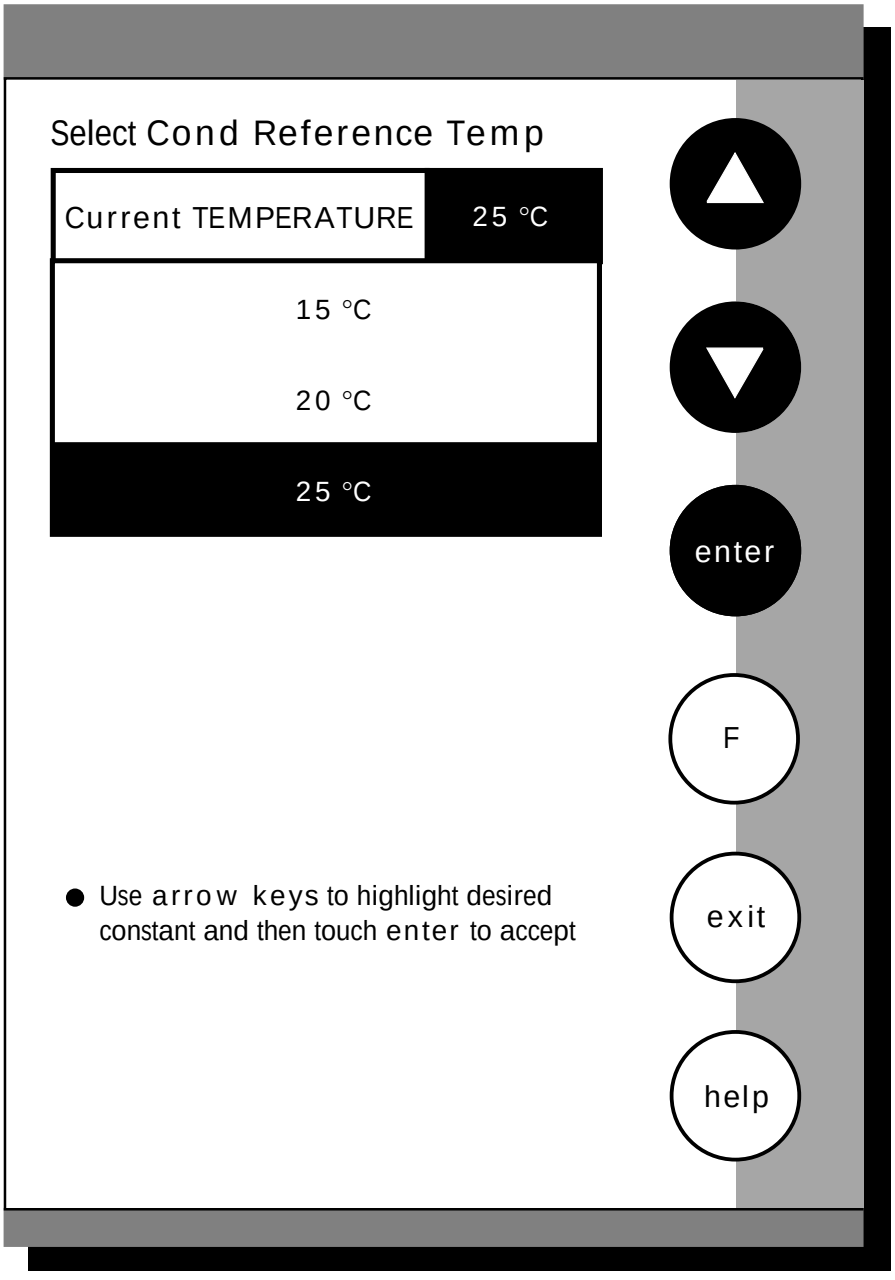
   OR

   Touch exit to return to the Conductivity Setup screen, without making any changes.

To Set Default Temperature

Conductivity is a temperature dependent measurement. This option allows you to select a default temperature that the meter will use along with the temperature coefficient to calculate a temperature corrected conductivity measurement. If an ATC probe is used any value entered as a default temperature will be overridden in favor of the actual measured temperature of the solution provided to the meter by the ATC probe.

The Conductivity Default temperature is set the same way as previously described in pH Setup. See page 60 for instructions.



To Select Reference Temperature

This screen allows you to select the reference temperature to be used in the determination of the conductivity of your sample.

1. Access the Select Reference Temperature screen from the Conductivity Setup screen. The current Reference Temperature is displayed.

2. Touch C or F to select the desired temperature units for the reference temperature.

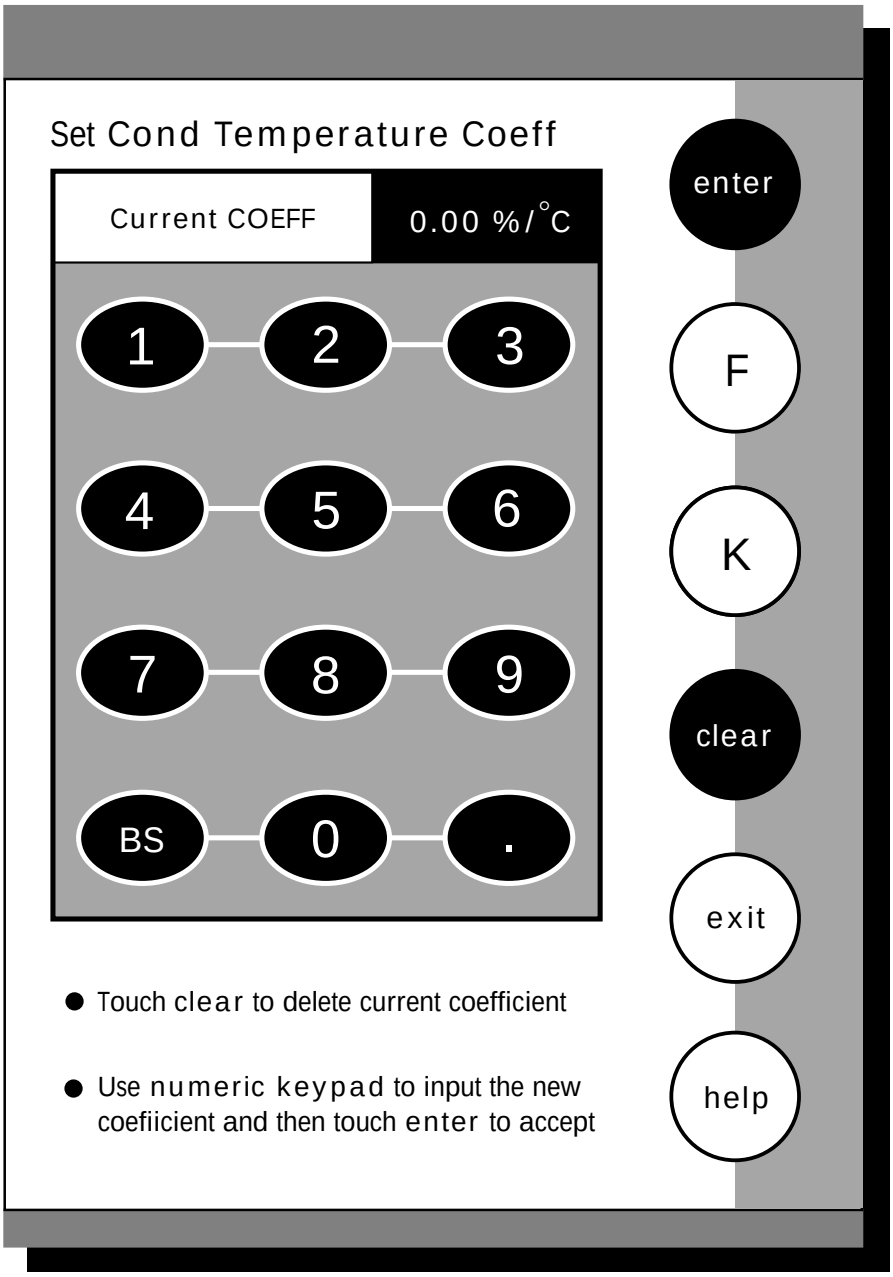
3. Use the arrow keys to highlight the desired reference temperature.

4. Touch enter to accept the reference temperature and return to the Conductivity Setup screen.

   OR

   Touch exit to return to the Conductivity Setup screen, without making any changes.

Note: The units of all temperature parameters must match. The meter will automatically modify units of Default Temperature, Reference Temperature and the Temperature Coefficient to match the last choice made on any of these 3 screens. If Kelvin is desired, it must be selected in either the Default Temperature screen or the Temperature Coefficient screen.



The temperature coefficient is a value that reflects the degree to which the sample's conductivity is effected by temperature changes. The meter will use the set temperature coefficient along with the measured temperature provided by the ATC probe to calculate what the conductivity would be at the selected reference temperature. If no ATC probe is being used, the meter will use the set default temperature in the calculation.

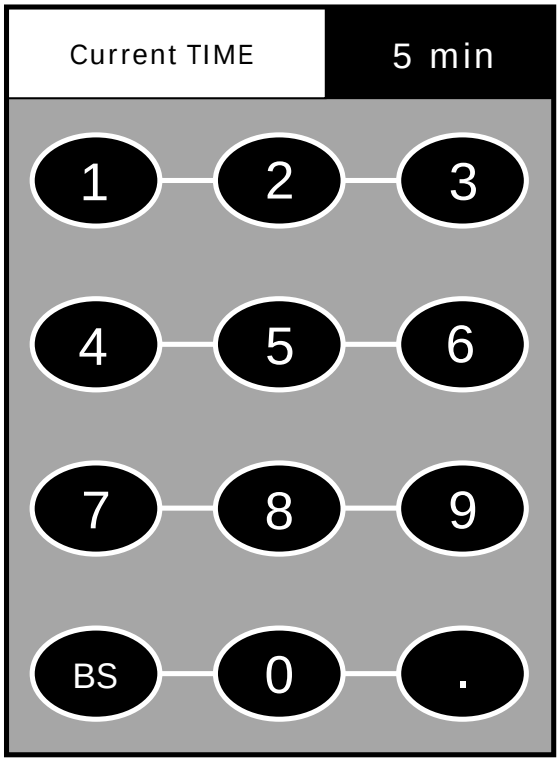
To Set Temperature Coefficient

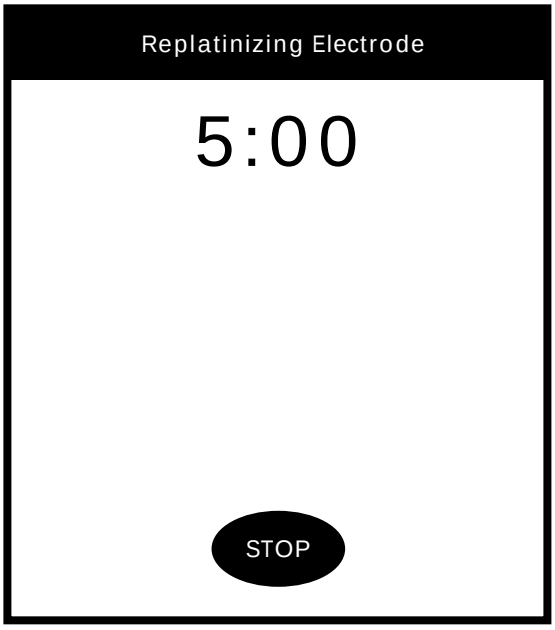
1. Access the Set Temperature Coefficient screen from the Conductivity Setup screen. The current Temperature Coefficient is displayed on the screen.
2. Touch clear to delete the current temperature coefficient.
3. Touch C, F, or K to select the desired temperature units for the temperature coefficient.
4. Use the keypad to enter the desired temperature coefficient.
5. Touch enter to accept the temperature coefficient and return to the Conductivity Setup screen.

   OR

   Touch exit to return to the Conductivity Setup screen, without making any changes.

Replatinize





Replatinization is the process of replacing the platinum on the surfaces of the 2 cell conductivity probes that may flake or wear off over time. The platinum on the surface of the probe is used to increase the surface area of the measuring surface resulting in decreased polarization error. Replatinization is a relatively quick procedure to perform, taking no more than 5 minutes in most cases. This meter is capable of performing replatinization from 1 to 30 minutes. Although replatinization is not a long process, the replatinization solution is costly. If you are not certain that replatinization will improve the performance of your accumet conductivity probe, please call the technical support hotline at 1-800-943-2006.

To Perform Replatinization

1. Access the Perform Replatinize screen from the Conductivity Setup screen. The current replatinization time is displayed on the screen.

2. Touch clear to delete the current replatinization time.

3. Use the keypad to enter the desired replatinization time.

4. Touch enter to accept the replatinization time.

5. Touch START on the display screen to begin the process of replatinization. At this time a countdown timer will appear on the display screen to let you know how much time is remaining in the replatinization procedure. At anytime after you have initiated the replatinization, you can touch STOP to abort the procedure and return to the Conductivity Setup screen.

   OR

   Touch exit on the display screen to cancel the replatinization process and return to the Conductivity Setup screen.

   OR

   Touch EXIT to return to the Conductivity Setup screen, without performing replatinization.

4-cell conductivity probes do not require replatinization.

To Set Alarm Limits

This option allows you to set alarm limits for the Conductivity measuring mode. If the conductivity value of the measurement is outside of the boundaries set by the upper and lower limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The Conductivity Alarm Limits are set the same way as previously described in pH Setup. See page 64 for instructions.

To Set Print Criteria

This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

The Conductivity Print Criteria are set the same way as previously described in pH Setup. See page 66 for instructions.

To Set Print Interval

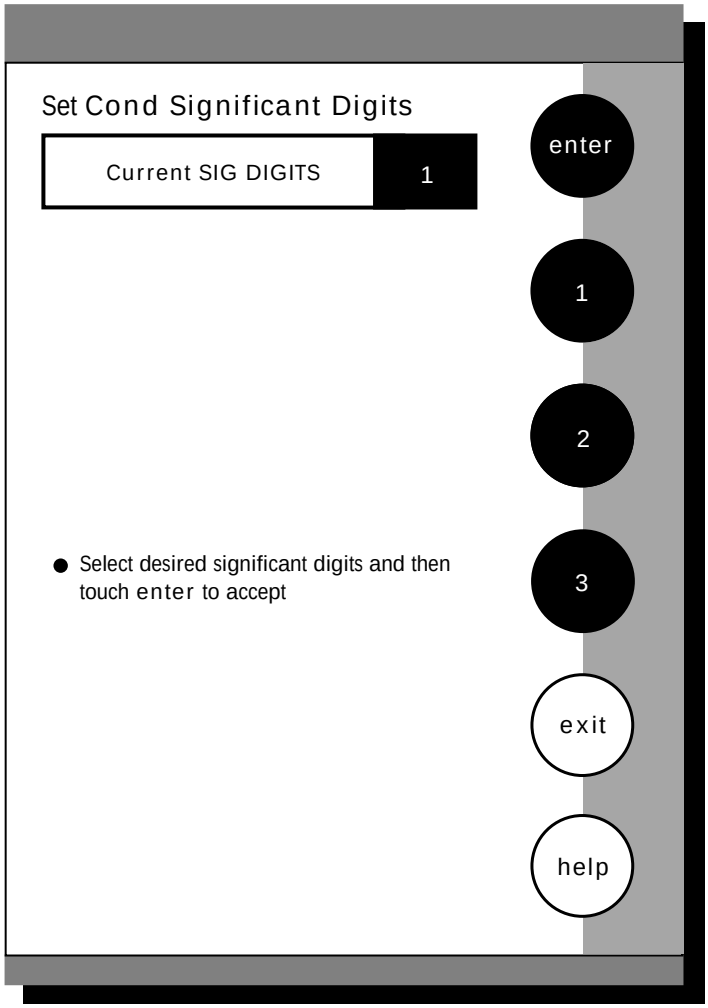
You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

The Conductivity Print Interval is set the same way as previously described in pH Setup. See page 68 for instructions.

To Set Data Storage Criteria

This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed on the View Stored Data screen with the previously stored data.

The Conductivity Data Storage Criteria are set the same way as previously described in pH Setup. See page 70 for instructions.



Example of 1 significant digit

Example of 2 significant digits

Example of 3 significant digits

This option allows you to select the number of significant figures that will be used when reporting your conductivity measurement. You have the choice of one, two or three significant digits.

To Set Significant Digits

1. Access the Set Significant Digits screen from the Conductivity Setup screen. The current Significant digits are displayed on the screen.
2. Touch 1, 2, or 3 to select the desired significant digits.
3. Touch enter to accept the number of significant digits and return to the Conductivity Setup screen.

   OR

   Touch exit to return to the Conductivity Setup screen, without making any changes.

To Set Display Configuration

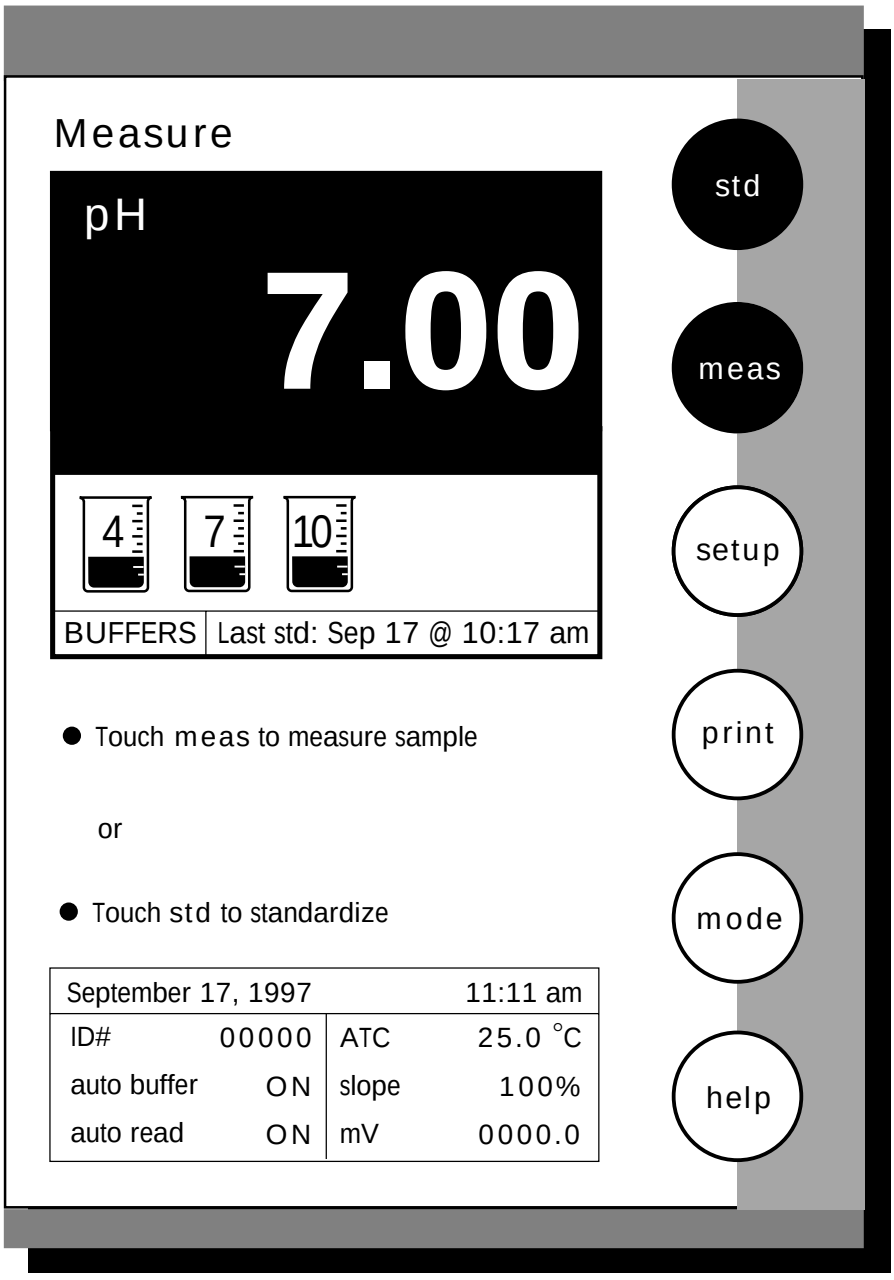
This function will allow you to choose what information you would like to be displayed on the Conductivity Measure screen, particularly the information contained in the data box at the bottom of that screen.

The Conductivity Display Configuration is set the same way as previously described in pH Setup. See page 74 for instructions.

To View Stored Data

This meter has memory capacity for up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

The Conductivity Stored Data is accessed the same way as previously described in pH Setup. See page 76 for instructions.



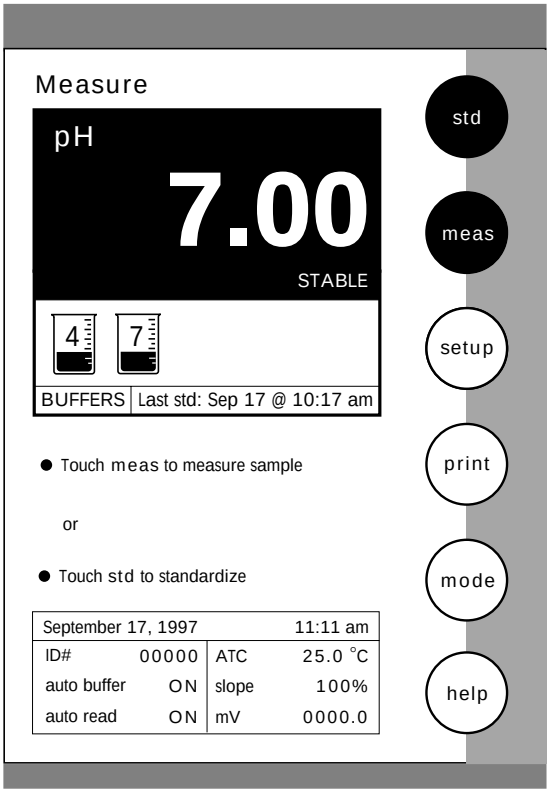
In this mode, you will be able to measure the pH of a wide variety of samples. Before measuring pH, you will need to standardize the meter using buffers with known pH values. It is good practice to standardize the meter frequently using a minimum of two buffers. Using two buffers allows the meter to calculate and display an actual slope for the electrode, and therefore produce more accurate measurements. If there is no standardization in the memory of the meter or if only one buffer has been used to standardize the meter, the slope value will appear as "NA".

You can standardize your meter using automatic or manual buffer recognition. With the Automatic buffer recognition activated, the meter will automatically recognize the buffers from the chosen buffer group and accept them when the meter recognizes the reading as stable. When in the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will accept the manually entered buffer when it recognizes that the measurement is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching Std. See page 56 to select desired buffer recognition.

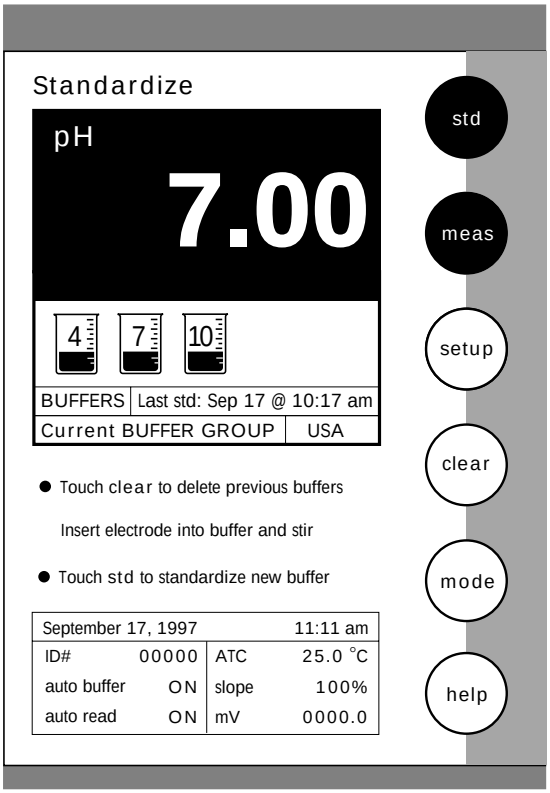
At the Basic Procedural level the only setup options that you can access are the Buffer Groups, the Print Interval and the Display Resolution. If you need to change any other parameter such as Buffer Recognition or Auto Read mode you will need to set the Procedural Level to Advanced in the System Setup screen. Any values previously saved in the pH Setup screen at the Advanced Procedural Level will become the default values for the Basic Procedural Level.

Remember to setup your pH measuring mode parameters. Refer to pages 44-79 for pH setup instructions.

Connect the electrodes you will be using to the meter. See page 10 for details.



Remember, HELP is always just a touch of the button away.



To Standardize the meter with Auto Buffer Recognition

1. Touch STD on the pH measure screen to access the standardize screen.

2. Touch clear to delete a previous standardization. All pH standardization values will be cleared. The meter will remain on the Standardization screen at this point.

   OR

   If the screen says "Not Standardized" proceed to step 3.

3. Immerse your rinsed electrode(s) in a buffer solution from the selected buffer group that you chose during the setup process (see pages 54) and stir gently.

4. Touch std again to standardize the meter using this buffer. The word MEASURING will flash until the signal is stable. The meter will accept the value once it recognizes that the reading is stable. At that time, STABLE will appear on the screen. A beaker icon and the entered pH value will also appear on the screen at this time. The meter will then return to the measure screen.

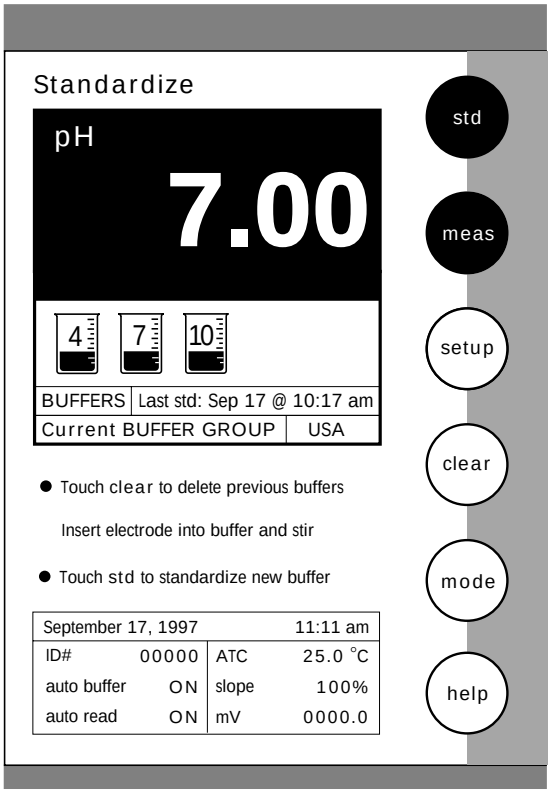
5. Touch std on the pH measure screen to access the standardization screen and repeat steps 3 through 5 to standardize with up to 5 buffers.

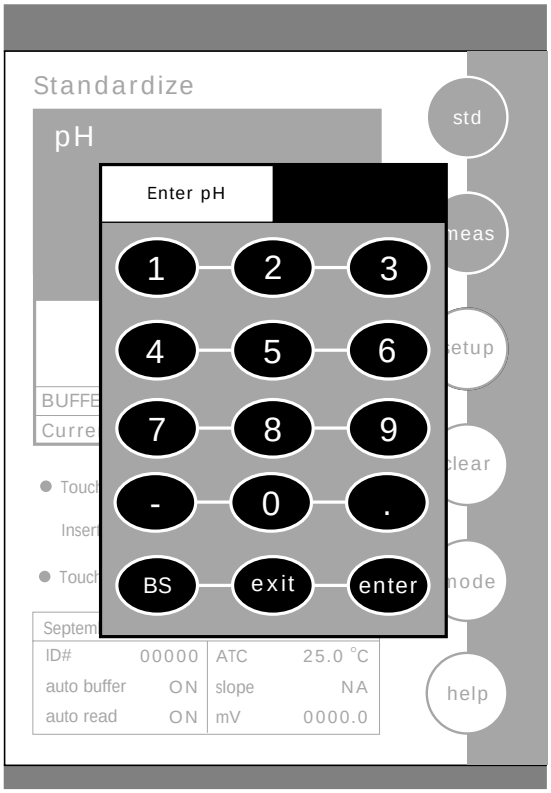
For optimal results, the meter should be standardized at a minimum of every 8 hours. For more accurate measurements, the meter should be standardized more frequently.

Updating a standardization with Auto Buffer Recognition:

You can update a standardization at anytime. To update a standardization, place your electrode in any of the buffers originally used to standardize the meter and touch std on the touch screen twice. The value for that buffer will be updated and stored in the meter's memory. The time of standardization will also be updated on the pH measurement screen.

The efficiency of the electrode is reported as the slope. When doing a multi-point standardization, the slopes of the individual segments are calculated by the meter. The slope that appears on the screen is the slope that is the least perfect, or the farthest from 100%.





To standardize the meter with manual buffer recognition

1. Touch std on the pH measure screen to access the standardize screen.

2. Touch clear to delete a previous standardization. All pH standardization values will be cleared. The meter will remain on the Standardization screen at this point.

   OR

   If the screen says "Not Standardized" proceed to step 3.

3. Immerse your rinsed electrode(s) in a buffer solution and stir gently.

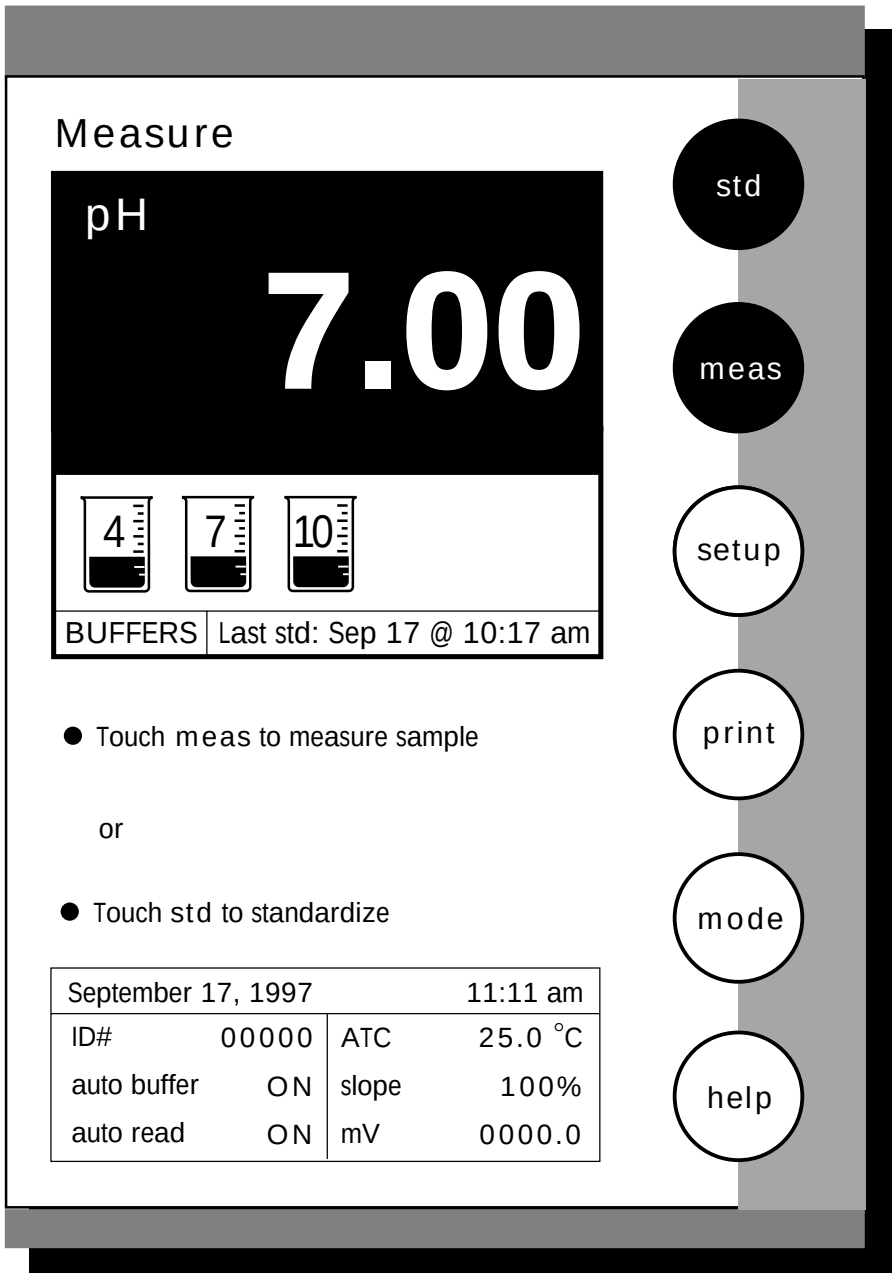
4. Touch std again to standardize the meter using this buffer.

5. Using the displayed keypad, input the value of the buffer that you are using to standardize the meter and then touch enter. The meter will accept the value once it recognizes that the reading is stable. At that time, STABLE will appear on the screen. A beaker icon and the entered pH value will also appear on the screen at this time. The meter will return to the pH measure screen.

6. Touch std on the pH measure screen to access the standardization screen and repeat steps 3 through 5 to standardize with up to 5 buffers.

Updating a standardization with Manual Buffer Recognition:

You can update a standardization at any time. To update a standardization with manual buffer recognition, place your electrode in any of the buffers originally used to standardize the meter and touch the std key on the touch screen twice. Then using the keypad displayed on the screen enter the value of the buffer and touch enter. The value for that buffer will be updated and stored in the meter's memory. The time of standardization will also be updated on the pH measure screen.



Remember, HELP is always just a touch of the button away.

The measure screen provides a readout of the current sample measurement. You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until meas is touched. If the Auto Read mode is inactive, then the meter will continuously monitor the pH of the sample and the measure display screen will indicate any fluctuation in the sample pH. Regardless of the status of the Auto Read mode, STABLE will flash as the meter recognizes the measurement as stable.

Once the meter is standardized, you are ready to take pH measurements of your sample.

To measure pH of a sample with Auto Read ON

1. Immerse the rinsed electrode(s) in the stirring sample.
2. Touch meas to begin measuring your sample. The meter will accept the reading and display STABLE when the measurement meets the selected stability criteria.

OR

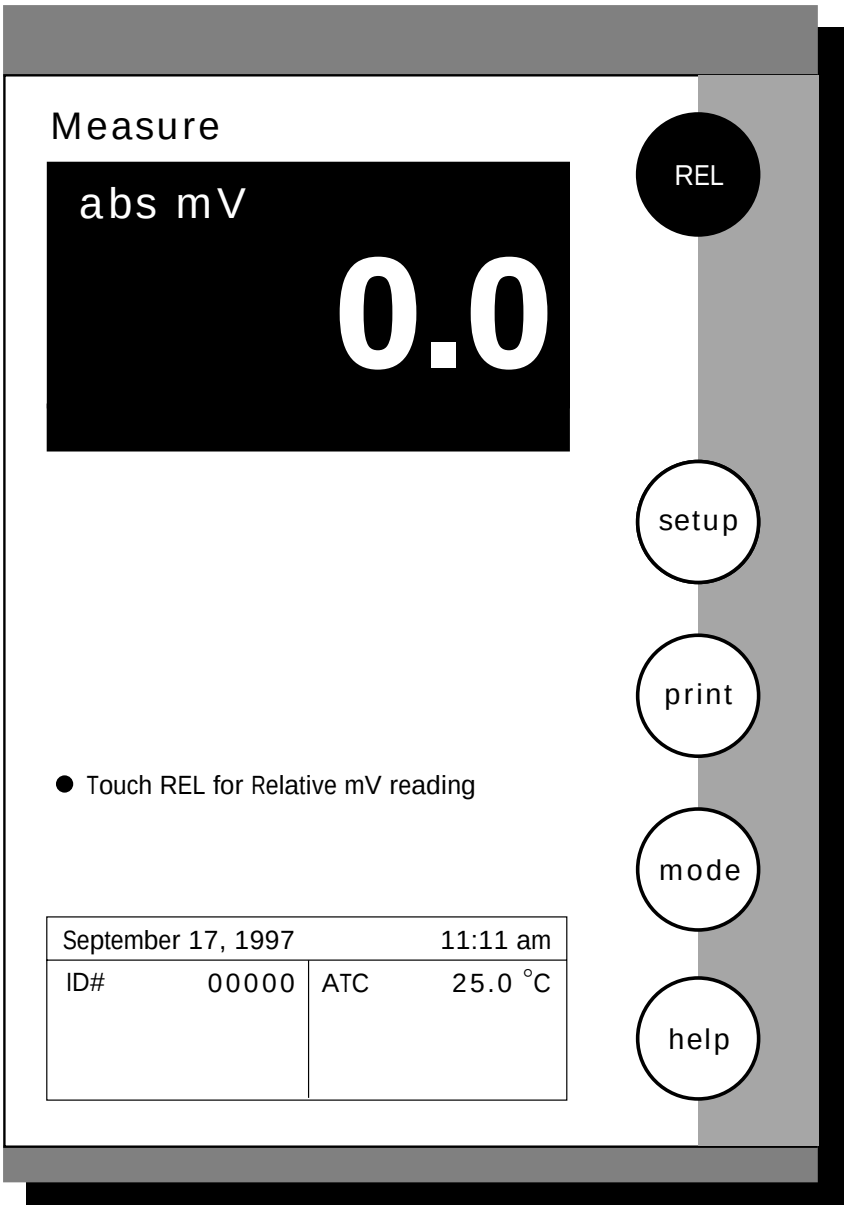
To measure pH of a sample with Auto Read OFF

1. Immerse the rinsed electrode(s) in the stirring sample.
2. Record the reading once the measurement has become stable. STABLE will appear once the meter recognizes that the measurement is stable.

NOTES: You can access other functions of the meter with the remaining buttons on the measure screen.

- Touching print will send the data to the meter's memory if the sample ID# is activated and to a printer or computer if it is attached to the meter. The saved data can be accessed through the View Stored Data screen in the pH Setup mode.
- Touching setup will access the pH Setup screen. For detailed information regarding pH Setup see pages 44-79.
- Touching meas will initiate a new measurement of a sample.
- At anytime, you can touch mode to access another mode of operation including: mV, rel mV, Cond or the setup mode or place the meter in the standby mode.

This mode is used to measure oxidation/reduction potential (ORP/redox), perform titration and to verify the function of the meter. The mV measure function allows you to continuously monitor the mV potential of the electrodes in use. This can be done in either absolute or relative mV.
In the millivolt mode, the current millivolt output from the electrodes being used is monitored and displayed on the screen. The meter will continually monitor the millivolt reading in this mode and will not lock onto a single reading. However, once the reading has become stable, a stable message will be displayed. Remember to setup your mV measuring mode parameters. Refer to pages 80-87 for mV setup instructions.



In the mV mode, you will be able to make measurements in either absolute or relative millivolts, access the mV Setup screens and print your results to a printer or a computer.

Connect the electrodes you will be using to the meter. See page 10 for details.

Absolute mV measurements

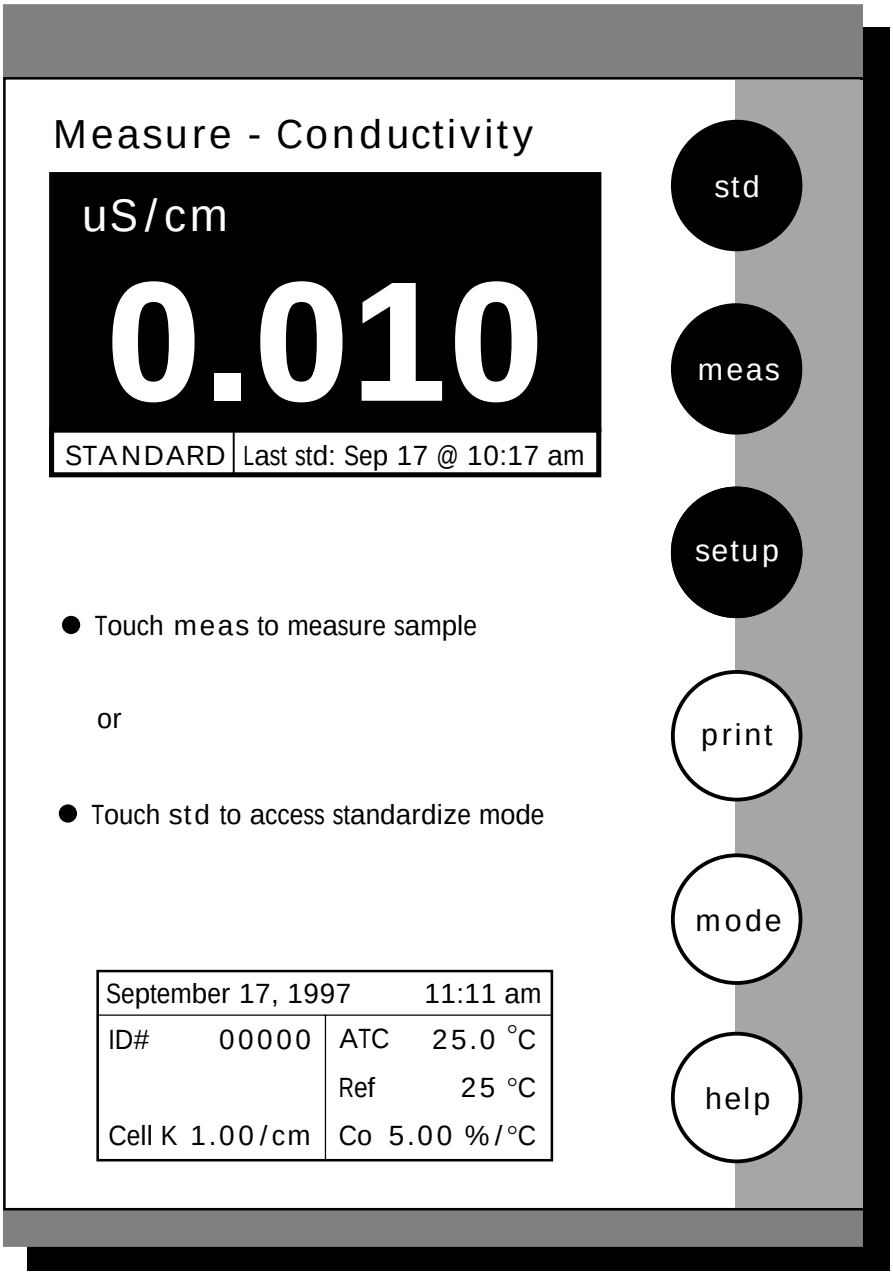
1. Access the mV Measure screen from the main screen.
2. Touch ABS to access the Absolute mV screen.
3. Immerse your rinsed electrode(s) in the sample and stir gently.
4. Record the measurement when STABLE is displayed.
5. Touch print to store a measurement with an assigned ID# in the data storage center of the meter or print the data to a printer or computer.

Rinse the electrode with water and blot dry. Do not wipe the electrode. Wiping the electrode can cause a static charge on the glass bulb that will result in inaccurate readings.

Relative mV measurements

In this mode, the first mV reading is set to zero and all subsequent readings are relative to this initial mV measurement.

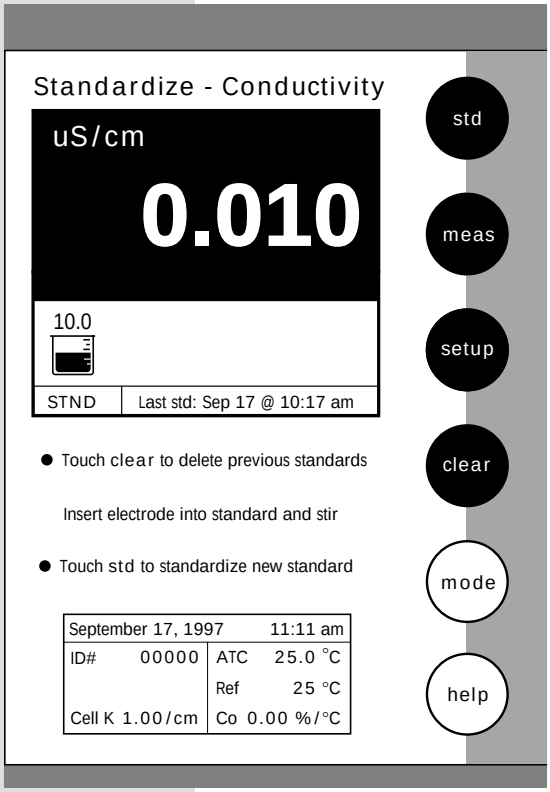
1. Access the mV Measure screen from the main screen.
2. Touch REL to access the Relative mV screen.
3. Immerse your rinsed electrode(s) in the stirring sample.
4. Record the measurement when STABLE is displayed.
5. Touch print to store a measurement with an assigned ID# in the data storage center of the meter or print the data on a printer or computer.

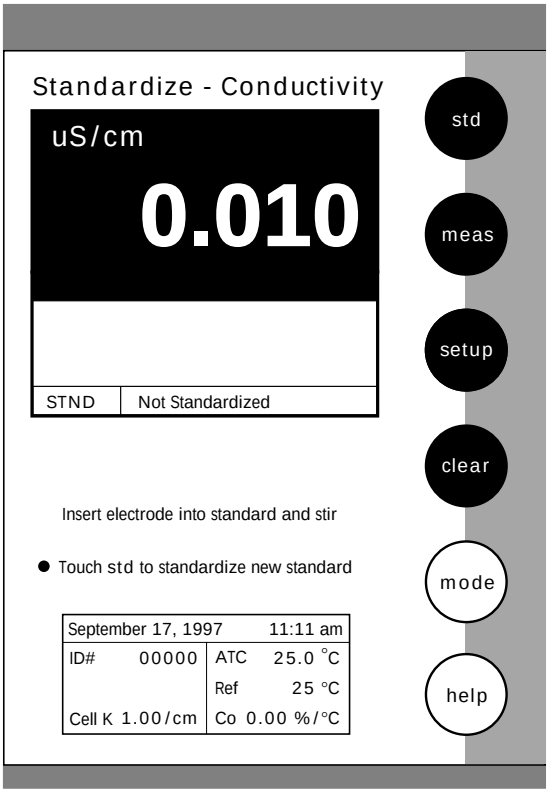


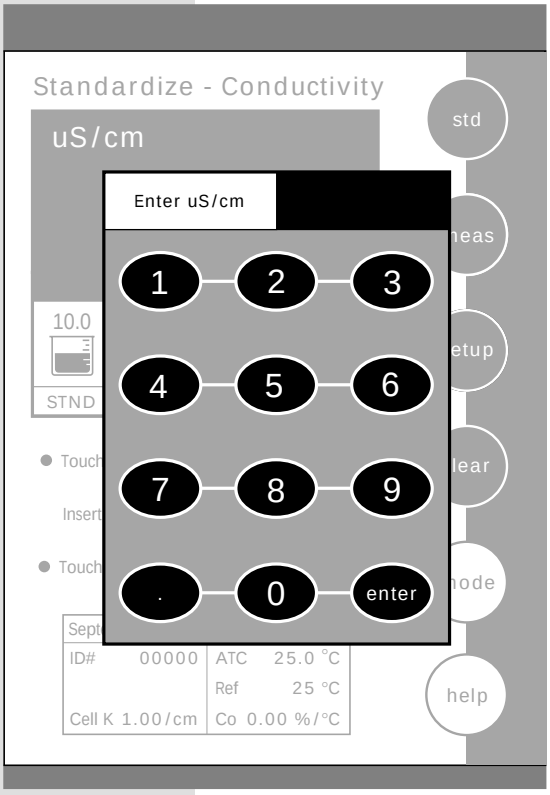
The meter will automatically convert conductivity values to salinity, total dissolved solids (TDS), or resistivity.

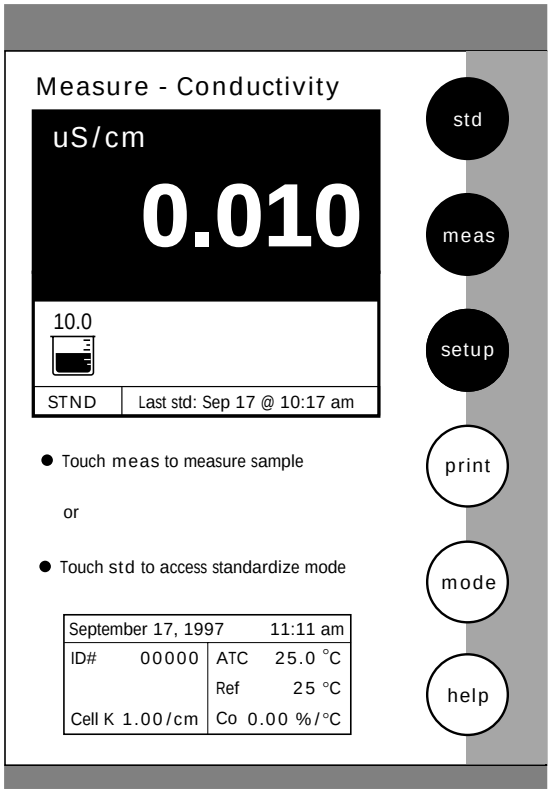
This mode allows you to measure the conductivity of solutions. Conductance is a value associated with the ability of primarily aqueous solutions to carry an electrical current. The presence of ions in an aqueous solution increases the solution's ability to carry an electrical current. Impurities in the solution, such as metals, dissolved soil, etc. increases the ion content of the solution. For this reason, conductivity is considered to be an indication of how clean the solution is. The meter will automatically convert conductivity measurements to salinity, Total Dissolved Solids, or resistivity measurements. The meter will continually monitor the conductivity reading in this mode and will not lock onto a single reading. However, once the reading has become stable, STABLE will be displayed. Remember to setup your conductivity measuring mode parameters. Refer to pages 88-105 for conductivity setup instructions.

Remember, HELP is always just a touch of the button away.









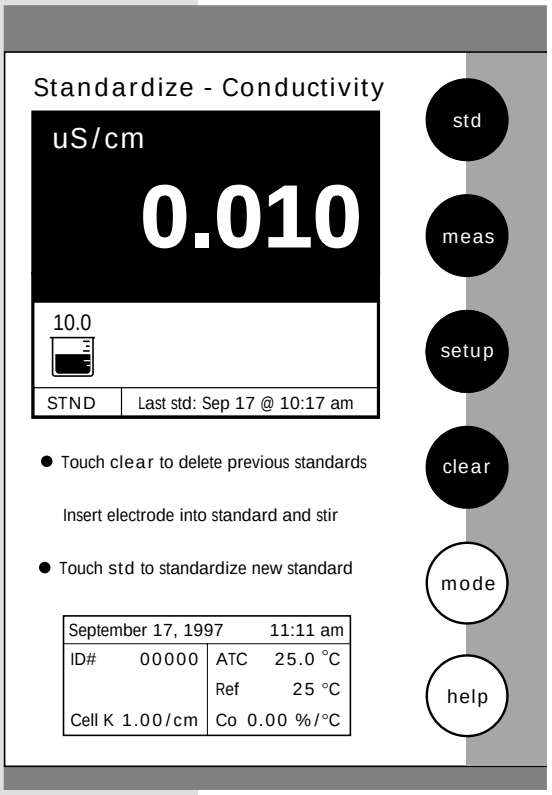
To "standardize" your conductivity probe in the Advanced Level of Operation

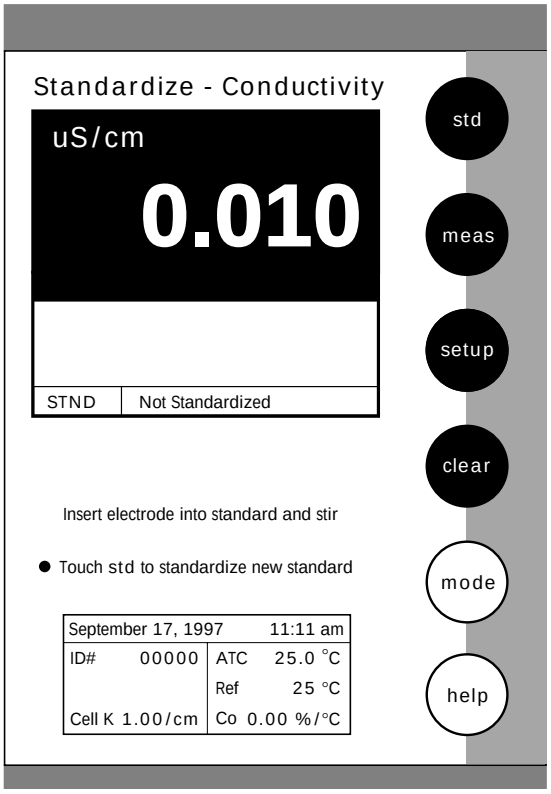
1. Access the Conductivity Setup screen and verify the values for the nominal cell constant of the probe, the reference temperature and the temperature coefficient. Also, verify that the meter is set for the µS/cm units.
2. Touch std on the Conductivity Measure screen to access the Conductivity Standardization screen.
3. Immerse the conductivity and ATC probes in the standard with a known conductivity value and stir.
4. Touch clear to delete previous standardization values.
5. Touch std to access the standardization mode again.
6. Use the keypad on the display screen to enter the value of the known conductivity standard.
7. Touch enter on the keypad to accept this conductivity standard and return to the Conductivity Measure screen.

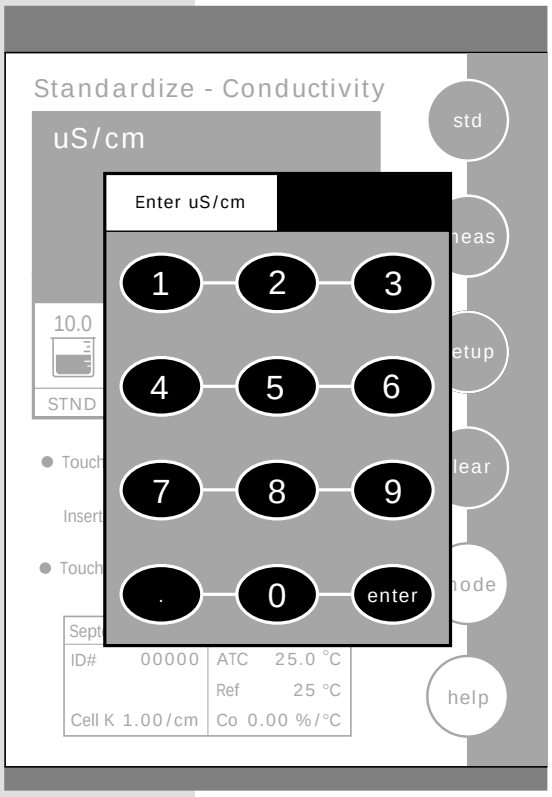
The actual cell constant will be displayed in the data box at the bottom of the Conductivity Measure screen.

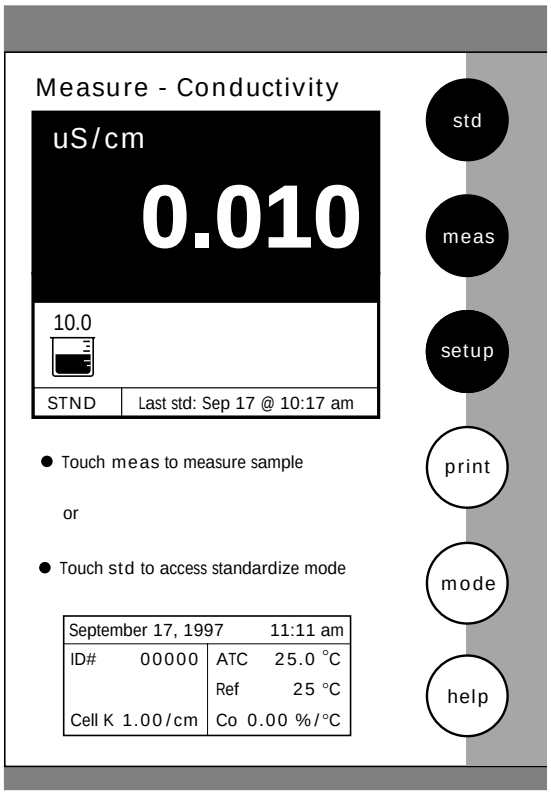
It is important to condition your conductivity probe according to the manufacturer's instructions prior to use.

You will only need one conductivity standard to standardize the meter.





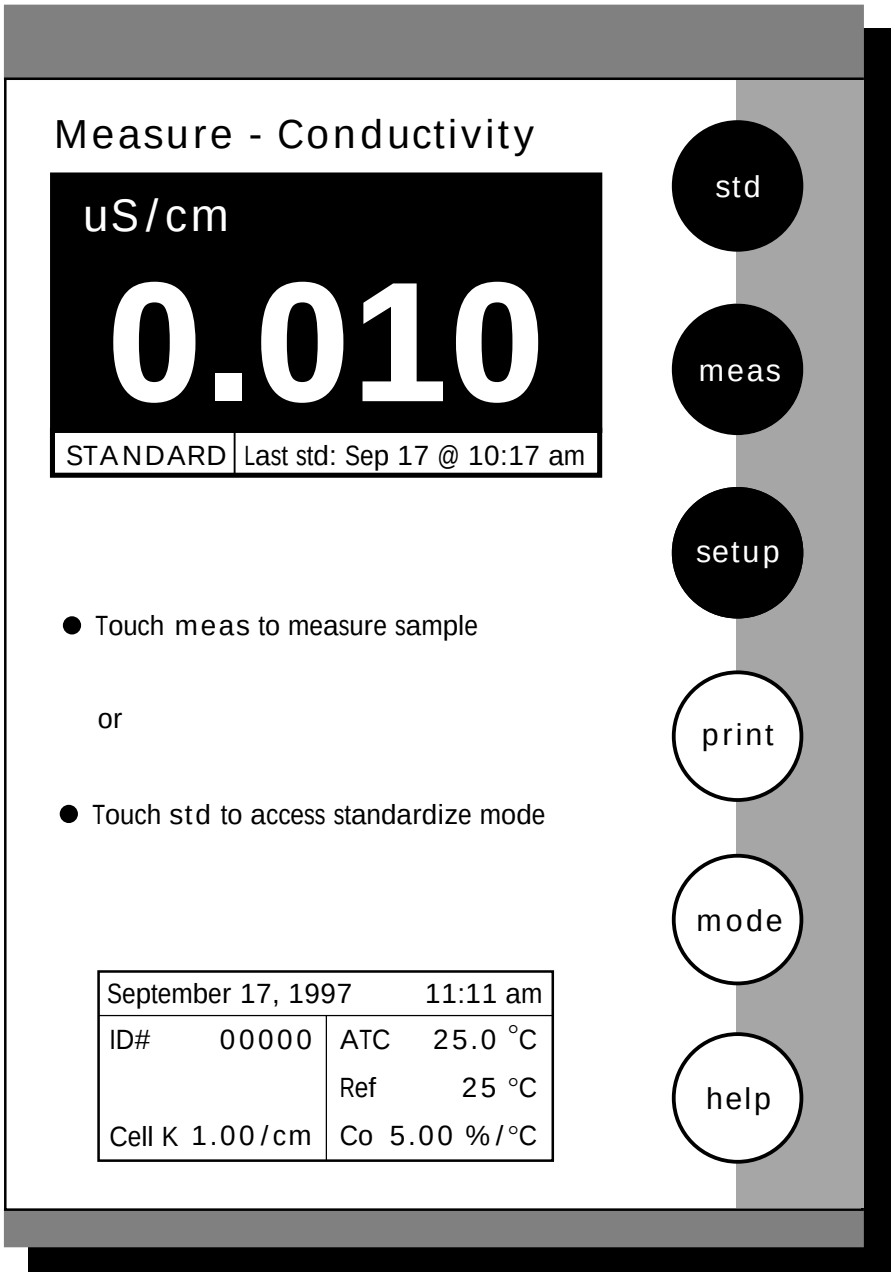




To "standardize" your conductivity probe in the Basic Level of Operation

At the Basic Procedural level the only setup options that you can access are the Cell Constant, the Print Interval and the number of Significant Digits. If you need to change any other parameter such as reference temperature or temperature coefficient you will need to set the Procedural Level to Advanced in the System Setup screen. Any values previously saved in the Conductivity Setup screen at the Advanced Procedural Level will become the default values for the Basic Procedural Level.

1. Access the Conductivity Setup screen and verify the value for the nominal cell constant of the probe.
2. Touch std on the Conductivity Measure screen to access the Conductivity Standardization screen.
3. Immerse the conductivity and ATC probes in the standard with a known conductivity value and stir.
4. Touch clear to delete previous standardization values.
5. Touch std to access the standardization mode again.
6. Use the keypad on the display screen to enter the value of the known conductivity standard.
7. Touch enter on the keypad to accept this conductivity standard and return to the Conductivity Measure screen.



Once an exact cell constant has been established, the meter is ready for sample measurements.

1. Immerse the conductivity cell and ATC probe into the sample solution. The immersion depth should be enough to cover the vent holes on the electrode.

2. Stir the solution with the electrode briefly and then let the electrode sit still in the solution.

3. Observe and record the measurement value when it appears to be stable (STABLE will appear). The meter will automatically change ranges from µS/cm to mS/cm as required.

4. Touch print to send the data to a printer or computer. If you have assigned a sample ID# to this sample, the data will be saved in the meter's data storage center when you touch print.

5. Repeat steps 1 through 4 for additional samples.

The touch screen should be kept as clean as possible to preserve optical properties. Attempt to keep the screen free of dirt, dust fingerprints, etc. Long term contact with abrasive materials will scratch the surface, and impair image quality. To clean, use a damp nonabrasive cloth towel and any commercially available window cleaner. The cleaning solution should be applied to the towel rather than the surface of the touch screen.

The case is made out of durable ABS plastic. It can be cleaned with a damp cloth and a mild detergent. Do not use chemical solvents on the case.

Your AR meter contains many error messages to provide aid should trouble occur with a measurement or meter operation (touchpad and input errors). The messages are accompanied by a brief description of the error, and in some cases advice on how to correct it. An example of an error message is:

Bad Electrode Slope-The electrode you have standardized has a slope which is out of the normally acceptable range of 90% to 102%.
You should try to restandardize, or replace your electrode if the problem persists. Note that you can continue to make measurements with this electrode; however, the readings may be inaccurate.

Other error messages delivered by the meter are:

Data log full
Data log empty
Unrecognized date
Unrecognized time
Invalid pH limit
Invalid Conductivity limit
Invalid limit
Limit exceeded
Invalid Temperature
Invalid Isopotential
Invalid Print Interval
Invalid pH value
Invalid Replatinize Time
Sample ID not found
Operator not found
Invalid Temperature Coefficient

Also, whenever possible, touch help for complete information about the meter operation in which you are currently engaged.

pH Meter and Electrode Warranty Statement

The Fisher Scientific Company ("Fisher") warrants to the direct purchaser that the accumet meters and Accumet, AccuTupH, AccuFET, AccupHast, and Microprobe electrodes will be free from defects in material or workmanship for a specified warranty period. During that period, Fisher will repair or replace the product or provide credit, at its sole option, upon prompt notification and compliance with its instructions. For accumet meters, that specified period is 24 months from delivery date. For electrodes, that specified period is 12 months - except for models 13-620-532, 13-620-533, 13-620-534, 13-620-535, 13-620-536, 13-620-537, 13-620-538 and 13-620-539 - which are warranted for six months.

Unless otherwise agreed, the warranty is limited to the country in which the product is sold.

No Fisher employee, agent or representative has the authority to bind Fisher to any oral representation or warranty concerning any product sold. Any oral representation or warranty made prior to purchase of any product and not set forth in writing and signed by a duly authorized officer of Fisher shall not be enforceable by the purchaser.

FISHER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Fisher's sole responsibility and the purchaser's exclusive remedy for any claim arising out of the purchase of any product listed above is repair, replacement or credit as described above, where applicable. In no event: 1) shall the cost of the exclusive remedy exceed the purchase price: 2) shall Fisher be liable for any special, indirect, incidental, consequential, or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Each article that Fisher furnishes will conform to the written specifications given in this manual, or those of a further improved model. Changes are made often to the information in the manual and will be incorporated into future editions.

Notice of Compliance

WARNING: This meter generates, uses, and can radiate radio frequency energy. If not installed and used properly, that is in strict accordance with the manufacturer's instructions, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

This product is to be used only as described in the manual. This product is for indoor use only, and must be used in a well ventilated area.

WARNING: To meet or exceed FCC regulations and comply with CE requirements, the Fisher-supplied power supply must be used. Use of a power supply that is not approved by Fisher Scientific may cause safety hazards and/or cause unit to exceed EMC limits and/or damage unit. When using this meter with a computer or printer, a shielded RS232 cable must be used to meet or exceed FCC regulations, and comply with CE Mark requirements.

The isopotential point of an electrode system is the point at which electrode potential is unaffected by a change in temperature. The coordinates of this point would be reported as (pX_{iso}, E_{iso}). For an ideal system, this point would be coincident with the system's Zero Potential Point (pX_{iso}, E_0).

In practical systems, however, this coincidence rarely occurs, and for some systems, there is no true Isopotential Point but a general Isopotential area. If a system exhibits an apparent Isopotential Point, or at least an Isopotential area with relatively small spread, Isopotential coordinates may be established and possibly used to some advantage.
Isopotential correction may be used only in conjunction with a One- or Two- Point Standardization; it is required only when both accuracy over a significant temperature range as well as operation with an asymmetric electrode system are contemplated. However, Isopotential correction is never necessary if all measurements will be performed on samples which are at similar temperatures. Most conventional pH electrode systems are designed and manufactured to be highly symmetrical cells. Consequently, for most pH work, unless ultimate accuracy over broad temperature ranges is required, Isopotential may be ignored. Specifically, this is accomplished by setting the Isopotential at its reset value of zero millivolts.

The following is an example for determining an Isopotential Point:

Data points are first established for three different standards at three different temperatures. The data points are then plotted and will produce three isotherms which should resemble the plot in either figure 1 or figure 2. In figure 1, the Isopotential Point is well defined as the millivolt difference between the coincidence point of the three Isotherms (pX_{iso}, E_{iso}) and the Zero Potential Point (E_0). The Isopotential Point is not so well defined in figure 2, but a value may be interpolated with some accepted error.

Figure 1

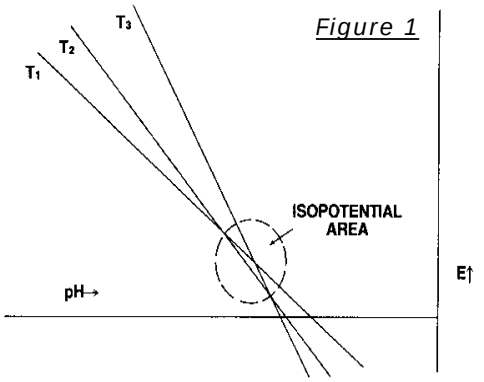
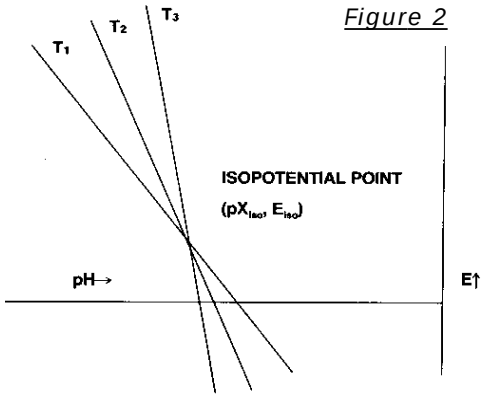


Figure 2



Your accumet pH meter is equipped with an RS-232 output port for sending measurement readings to a printer or computer. To use the meter with a printer or computer, the printer or computer must have an RS-232 port, also. It should be capable of receiving data within the following guidelines.

Baud rates	110 to 38,400 BPS
Data bits	7 or 8
Parity	even, odd, or none
Stop Bits	1 or 2

The meter and the output device must be configured to match with respect to these parameters.

A shielded RS-232 cable must be used. The RS-232 connector is on the back of the meter. (see diagram page 8) The connector is a Female DB9 style connector. If the output device has a 25-pin connector, an adapter is required. If the meter and the printer or computer are to work together, the pin configurations must match. The meter's 9-pin configuration is as follows.

Pin	Description
1	Buffers analog copy of pH input 1
2	Send data from meter
3	Receive data to meter
5	Signal Common
9	Signal Common

To initiate printing, touch print if in the manual print mod, or set the print interval for stable readings or at a prescribed timed interval. Refer to the setup sections, Set Print Interval and Set Print Criteria.

To download data stored in memory to a printer or computer, access the View Stored Data option in the setup screens. Access the desired data point by sorting the data by one of the three options. Touch print on the screen displaying the data

The following is the list of factory default settings for the accumet AR20 meter. You can reset your meter to the factory default settings by accessing the Reset to Factory Defaults screen from the System Setup screen.

Mode	Screen	Default Setting
System Setup	Time	12 hour time mode
	Date	month/day/year
	Print Configuration	Baud rate 19200
		Parity none
		Data bits 8
		Stop bits 1
	Procedural Level	Advanced
	Operator ID	none
	Beeper Status	ON
	Display Contrast	15
pH Setup	Display Configuration	All parameters ON
	Print Configuration	All parameters ON
	Data Configuration	All parameters ON
	Buffer Group	USA
	Sample ID#	none
	Isopotential Point	0 mV
	Print Interval	manual
	Display Resolution	X.XX
	Auto Buffer Recognition	ON
	Auto Read Mode	OFF
	Temperature Units	Celsius
	Default temperature	25.0°C
	Stability Criteria	Medium
	Default slope	59.16 mV
	Alarm limits	OFF
	Alarm limit low	0.000
	Alarm limit high	14.000
mV Setup	Display Configuration	All parameters ON
	Print Configuration	All parameters ON
	Data Configuration	All parameters ON
	Sample ID#	none
	Print Interval	manual
	Display Resolution	X.X
	mV readings	Absolute mV
	Alarm limits	OFF
	Alarm limit low	-1800.0
	Alarm limit high	1800.0

Mode	Screen	Default Setting
Conductivity	Display Configuration	All parameters ON
	Print Configuration	All parameters ON
	Data Configuration	All parameters ON
	Sample ID#	none
	Print interval	manual
	Display Resolution	2 Significant Digits
	Temperature Units	Celsius
	Default temperature	25.0 °C
	Reference Temp	25.0 °C
	Temperature Coeff.	0
	Cell constant	1
	Units	µS/cm
	Alarm Limits	OFF
	Alarm Limit low	0.00
	Alarm Limit high	1.00 E^6

Since its introduction by the Danish chemist Sorensen in 1909, pH measurement has become one of the most commonly used and important measurements in both laboratory and industrial settings. pH measurement and control is vital to a wide array of endeavors including municipal and industrial wastewater treatment, and textile, pharmaceutical, food, and petroleum production. Even our very existence itself is dependent upon pH. Most organisms can exist only within a narrow pH range. In humans, for example, the pH of blood must be maintained within the pH range of 7.3 to 7.4 .

In general, pH is a measure of the degree of acidity or alkalinity of a substance. It is related to the effective acid concentration ("activity") of a solution by this defining equation:

$$pH = -\log aH_3O^+$$

with aH_3O^+ representing the activity or effective concentration of the hydronium ion in solution.

Analysts traditionally work with concentration units rather than activity. Therefore neglecting activity, pH can be defined by the following equation:

$$pH = -\log [H_3O^+]$$

with $[H_3O^+]$ representing the concentration in Moles/liter of the hydronium ion in solution.

The pH range includes values from 0 to 14. Values from 0 to 7 represent the acidic half of the scale. Values from 7 to 14 represent the alkaline or basic half of the scale. The pH value 7 is considered neutral, as it is neither acidic or alkaline.

The pH scale is based on the dissociation constant of water. Water, even in its purest state, dissociates as follows producing a positively charged hydronium ion (H_3O^+) and a negatively charged hydroxyl ion (OH^-):

$$2H_2O = H_3O^+ + OH^-$$

At 25°C in pure water, the concentration of hydronium ions is extremely small, 1 x 10^{-7} Moles/liter, and balanced by an equal concentration of hydroxyl ions. The equilibrium constant, Kw of water is the product of the hydronium ion and hydroxyl ion concentrations:

$$Kw = [H_3O^+]\,[OH^-] = [1x10^{-7}]\,[1x10^{-7}] = 1x10^{-14}$$

Since the hydronium ion concentration is 1 x 10^{-7} Moles/liter, the pH of pure water is *7* , the neutral pH, as stated above:

$$pH = -\log [1 \times 10^{-7}] = 7$$

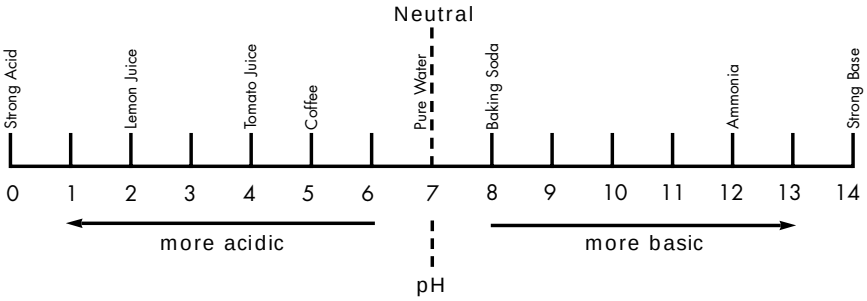
In aqueous solutions at 25°C, the product $[H_3O^+]\,[OH^-]$ or the Kw of water must remain constant. Therefore, an increase in concentration of either term, $[H_3O^+]$ or $[OH^-]$, will result in a decrease in the other. For example, if a strong base, sodium hydroxide (NaOH) is added to water to the extent that its final concentration is 0.01 Moles/liter, the concentration of the OH^- ion is 0.01 Moles/liter, and the concentration of the H_3O^+ must decrease according to the Kw equation as follows:

$$[H_3O^+] = Kw/\,[OH^-] = 1 \times 10^{-14}/\,1 \times 10^{-2} = 1 \times 10^{-12}$$

The pH of this solution is:

$$pH = -\log [1 \times 10^{-12}] = 12$$

This high pH indicates that the 0.01 M NaOH solution is strongly alkaline; the concentration of hydronium ions is extremely small.



pH Measurement

The pH value of a sample can be determined in several ways. These include the use of organic dyes which change color in certain pH ranges. The dyes can be added directly to the solution or impregnated onto paper which may be dipped into the solution. At best, these "colorimetric" methods yield approximate pH values, often with an accuracy of plus or minus 0.5 pH units.

The preferred and most accurate way to measure a pH value is the potentiometric measurement, using a pH electrode, a reference electrode, and a pH meter. This method is based on the fact that certain electrodes, immersed in solution, produce a millivolt potential (i.e. voltage) that is related to the hydronium ion concentration or pH of a solution in a precise way.

The relationship between the electrode's voltage and the solution pH is defined by the Nernst equation:

$$E_{meas} = E^* - \left(\frac{2.3RT}{nF}\right)(pH)$$

In this equation, E_{meas} is the voltage output of the electrodes, E* is the total of all other voltages in the system including the reference voltage, R is the Gas Law constant, T is the temperature in °Kelvin, n is the charge on the hydronium ion (+1), and F is the Faraday constant.

pH Meter

The pH meter is a sensitive voltmeter capable of accurately measuring small voltage differences between the pH electrode and the reference electrode. This voltage difference is amplified, and shown as a pH reading. Almost all modern meters are microprocessor controlled, and programmed to use electrode voltages, efficiency, and temperature to calculate an accurate pH for the sample. Since the voltage output from different electrodes will vary, it is essential to calibrate a pH meter. The ability to calibrate or to standardize a pH meter permits the meter to match the pH reading on the meter with the known pH value of a buffer solution. For best accuracy, it is recommended that at least two buffer solutions be used to calibrate a pH meter. Buffer solutions are available as ready-to-use solutions, concentrated solutions, capsules, or prepackaged salts. The following table lists three of the most widely used NIST buffers along with their pH values at different temperatures.

Temperature	4.01	6.86	9.18
0	4.003	6.984	9.464
10	3.998	6.923	9.332
20	4.002	6.881	9.225
25	4.008	6.865	9.180
30	4.015	6.853	9.139
40	4.035	6.838	9.068
50	4.060	6.833	9.011

pH Electrodes

The electrode system consists of two half cells: a pH indicating electrode, which is primarily responsive to the acidity (the hydronium ion concentration) of a solution, and a reference electrode, which provides a constant voltage and completes the electrical circuit.

Traditional pH indicating electrodes use a tip made of pH sensitive glass. Inside this electrode is a buffer solution with a fixed pH and ionic strength. A silver wire coated with silver chloride is immersed inside this internal solution, and establishes electrical contact between the solution and the meter. The voltage associated with this wire and the voltage associated with the pH of the internal solution and the inside wall of the pH sensitive glass tip remain constant. Therefore, changes in voltage from this electrode result from the voltage developed between the solution and the outside of the glass tip.

If the pH sensitive glass tip or membrane is to function properly, it must be hydrated. A dry or dehydrated electrode membrane will not respond properly to changes in acidity. pH electrodes are also effected by changes in temperature, and the presence of other ions. Temperature effects can be countered by temperature compensation functions on the pH meter. While temperature compensation will not allow you to predict what the pH of the sample is at another temperature, it will permit you to accurately assess the pH at whatever temperature you are presently working. pH sensitive membranes are also sensitive, though to a lesser extent, to other ions than the hydronium ion. For example, most pH glasses are somewhat sensitive to sodium ion as well. For some pH glasses, this means an error as high as 0.5 pH units in highly alkaline, high-sodium solutions. The special FS-5 glass used in Fisher's pH electrodes exhibits much less sodium error in these solutions, <.05 pH units.

Reference electrodes typically consist of three elements: an internal reference electrode, a filling solution, and a reference junction through which the filling solution can "flow", and provide electrical contact with the sample and the internal reference electrode. The most convenient internal reference electrodes are made from a metal (such as silver or mercury) and its sparingly soluble salt (silver chloride or mercurous chloride). The filling solution is most often a concentrated solution of potassium chloride. Most problems with reference electrodes are associated with the interruption or blockage of flow of the potassium chloride fill solution through the reference junction.

The classic electrode pair, separate pH indicating and reference half cells, offer you unmatched versatility to match the needs of your sample. This approach makes for the highest accuracy, as well as low replacement costs, since usually only one of the pair is broken or malfunctioning.

However, the pH indicating half-cell and the reference half-cell can be merged into one electrode - a combination electrode. Combination electrodes are quite popular for they offer distinct advantages in convenience and compactness. Some combination electrodes also incorporate an ATC probe into their body also, providing temperature readout and compensation with meters equipped with these features. Newer combination electrodes are available in which the glass pH membrane sensor has been replaced with a field effect transistor or FET. All of Fisher Scientific's AB and AR meters are capable of using this type of electrode by direct connection (except AB30).

Conductance is a quantity associated with the ability of primarily aqueous solutions to carry an electrical current, I, between two metallic electrodes when a voltage E is connected to them. Though water itself is a rather poor conductor of electricity, the presence of ions in the water increases its conductance considerably, the current being carried by the migration of the dissolved ions. This is a clear distinction from the conduction of current through metal, which results from electron transport. The conductance of a solution is proportional to and a good, though nonspecific indicator of the concentration of ionic species present, as well as their charge and mobility. It is intuitive that higher concentrations of ions in a liquid will conduct more current. Conductance derives from Ohms law, E = IR, and is defined as the reciprocal of the electrical resistance of a solution.

$C = 1/R$ C is conductance (siemens)
R is resistance (ohms)

One can combine Ohms law with the definition of conductance, and the resulting relationship is:

$C = I/E$ I is current (amps)
E is potential (volts)

In practice, conductivity measurements involve determining the current through a small portion of solution between two parallel electrode plates when an ac voltage is applied. Conductivity values are related to the conductance (and thus the resistance) of a solution by the physical dimensions - area and length - or the cell constant of the measuring electrode. If the dimensions of the electrodes are such that the area of the parallel plates is very large, it is reasonable that more ions can reside between the plates, and more current can be measured. The physical distance between the plates is also critical, as it effects the strength of the electric field between the plates. If the plates are close and the electric field is strong, ions will reach the plates more quickly than if the plates are far apart and the electric field is weak. By using cells with defined plate areas and separation distances, it is possible to standardize or specify conductance measurements.

Thus comes the term specific conductance or conductivity.

The relationship between conductance and specific conductivity is:

Specific Conductivity, S.C. = (Conductance) (cell constant, k) = siemens * cm/cm^2 = siemens/cm

C is the Conductance (siemens)
k is the cell constant, length/area or cm/cm^2

Since the basic unit of electrical resistance is the ohm, and conductance is the reciprocal of resistance, the basic unit of conductance was originally designated a "mho" - ohm spelled backwards - however, this term has been replace by the term "siemen". Conductivity measurements are reported as Siemens/cm, since the value is measured between opposite faces of a cell of a known cubic configuration. With most aqueous solutions, conductivity quantities are most frequently measured in microSiemens per cm (µS/cm) or milliSiemens per cm (mS/cm).

The accumet AR50 meter automatically converts conductivity readings from micro or milli Siemens to other derived units that are widely used. These are ppt salinity, ppm TDS (total dissolved solids), and resistivity.

The salinity scale which ranges from 2 to 42 is a measure of all salts, not just sodium chloride. This scale was originally devised for seawater, and is based on seawater at 15 degrees Centigrade having a conductivity equivalent to that of a potassium chloride solution of a known concentration. This solution (0.44 molal) is defined as having a salinity of 35 ppt.

The total dissolved solids scale approximates the ppm TDS in surface waters by multiplying the conductivity of a sample by a factor, 0.66.

Some users prefer the use of resistivity units to describe their water, particularly where high purity water is involved. The unit most often used to describe resistivity is megohm·cm., which ar simple the reciprocal of conductivity (µS/cm). The chart below shows the relationship between these units.

Conductivity, µS/cm	Resistivity, megohm·cm
0.056	18
0.1	10
1.0	1.0
2.5	0.4
10.0	0.1

Conductivity Measurement

Accumet conductivity electrodes consist of glass or epoxy bodies in which platinum or platinized sensing elements are fixed. Typically, each electrode has two such sensing elements and are designated two-cell electrodes. The previous discussion has focused on this type of electrode. Four cell electrodes are also available, and the theory and application of these are in a separate section.

These sensors contact the solution whose conductivity value is sought. The exact cell constant of the electrode must be determined prior to measuring the sample. In essence, this is accomplished by fixing the nominal cell constant of the electrode into the meter, and recording the observed conductivity value associated with a standard conductivity solution (usually a KCl solution) with a precisely known value. The following calculation yields the actual cell constant.

k = standard value of solution (µS)/ observed value of solution (µS)

Fortunately, the accumet AR20 meter automatically does this calculation for you by touching the std button.

To produce an appropriate current signal for the meter it is important to choose an electrode with an appropriate cell constant. The following table lists the optimum conductivity ranges for electrodes with cell constants of 0.1, 1, and 10.

	Optimum Conductivity Range
Cell Constant	2-cell
0.1	0.5 to 200 µS/cm
1.0	0.01 to 2 mS/cm
10.0	1 to 200 mS/cm

Prior to use the electrodes should be conditioned in distilled or deionized water for at least 10 minutes or in accordance with the manufacturer's instructions.

The four-cell electrode

Traditionally, conductivity measurements were made with a "two cell" electrode. This electrode used two metallic sensors, and anode and a cathode to which ions migrated. Under the influence of DC current, the electrodes quickly became polarized. In this situation, molecules formed at the electrode surfaces and ions migrating to the area collect around the respective anode or cathode and actually screen it from other ions. In essence the flow of ions stops, and current ceases to flow. Polarization and associated errors can be minimized by using AC voltage, the appropriate cell constant, and a large electrode surface area. The influence of polarization can also be minimized by the use of a four - cell electrode.

The four cell configuration consists of two cells, and outer cell and an inner cell. Voltage is applied to the sensors of the outer cell, which in turn generates a voltage across the sensors of the inner cell. The inner cell is connected to a high impedance circuit and, unlike the outer cell generates no current. Since no current is generated across the inner cell, polarization cannot occur at the inner cell. By measuring the voltage of the inner cell, which is adjusted to match the reference voltage by increasing or decreasing the current through the inner cell, one obtains a true picture of conductivity minus the influence of polarization.

	Optimum Conductivity Range
Cell Constant	4-cell
0.1	Not Available
1.0	0.01 to 20 mS/cm
10.0	1 to 200 mS/cm

Conductivity and Temperature

Conductivity in aqueous solutions reflects the concentration, mobility, and charge of the ions in solution. The conductivity of a solution will increase with increasing temperature, as many phenomena influencing conductivity such as solution viscosity are affected by temperature.

The relationship between conductivity and temperature is predictable and usually expressed as relative % change per degree centigrade. This temperature coefficient (% change per degree) depends on the composition of the solution being measured. However, for most medium range salt concentrations in water, 2% per degree works well. Extremely pure water exhibits a temperature coefficient of 5.2%, and concentrated salt solutions about 1.5%.

Since temperature effects the conductivity measurement so profoundly, the usual practice is to reference the conductivity to some standard temperature. This is typically 25°C, but the AR20 also permits the choice of 15°C and 20°C in the Select Temperature Coefficient option in the setup menu.

The AR20 permits you to enter the temperature coefficient which best suits your sample and use an ATC probe to automatically temperature compensate back to the chosen reference temperature. Refer to the Select Temperature Coefficient option in the Setup menu.

If you do not use an ATC probe or do not enter one of the three coefficients available in setup, the meter uses a temperature coefficient of 0.0% per °C. Under these conditions the meter does not automatically temperature compensate.

Replacement Parts

Description	Fisher Catalog Number
Accumet pH combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-285
ATC Probe	13-620-19
AccuFlex electrode support arm	13-637-671
Electrode support bracket	13-637-671A
Power Supplies: 115V, US plug	13-636-100
230V, UK plug	13-636-101
230V, Europe plug	13-636-102
Operator's Manual	13-636-AR50M
BNC Shorting cap	13-620-99

Accessories

pH Electrodes	Fisher Catalog Number
Accumet pH combination electrode, single junction, calomel reference, glass body, BNC connector	13-620-286
Accumet 3-in-1 pH/ATC combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-530
Accumet 3-in-1 pH/ATC combination electrode, single junction, calomel reference, glass body, BNC connector	13-620-531
AccupHast pH combination electrode, double junction, glass body, BNC connector	13-620-296
AccupHast pH combination electrode, double junction, epoxy body, BNC connector	13-620-298
AccuFET solid state pH/ATC combination electrode, Ag/AgCl gel reference	13-620-755

pH Buffers and Solutions

pH	Color	Ingredients	Size	Fisher Catalog Number
4.00	Red	Potassium Biphthalate	500 mL	SB101-500
7.00	Yellow	Potassium Phosphate Monobasic & Sodium Hyroxide	500 mL	SB107-500
10.00	Blue	Potassium Carbonate, Potassium Borate & Potassium Hydroxide	500 mL	SB115-500
Fisher Buffer-Pac		(500mL ea. of color coded pH 4, 7, and 10 buffers)	3x500 mL	SB105
4.00	Red	Individual Tear open pH Packets	20/box	SB4
7.00	Yellow	Individual Tear open pH Packets	20/box	SB7
10.00	Blue	Individual Tear open pH Packets	20/box	SB10
	Gray	Electrode Rinse Individual Tear open pH Packets	20/box	SB15
		Electrode Storage Solution	1L	SE40-1

Accumet Immersion Type Conductivity Electrodes

	2 Cell Conductivity Cell		4 Cell Conductivity Cell	
	Glass Body	Epoxy Body	Glass Body	Epoxy Body
Cell constant 0.1 cm^{-1}	13-620-156	13-620-161	–	–
Cell constant 1.0 cm^{-1}	13-620-155	13-620-160	13-620-163	13-620-165
Cell constant 10.0 cm^{-1}	13-620-157	13-620-162	13-620-164	13-620-166

Conductivity Standards

Conductivity	Resistivity	Dissolved Solids	16 oz bottle	100mL bottle
10 µmhos	0.1 megaohms	6.5 ppm	09-328-1	09-328-6
100 µmhos	0.01 megaohms	65 ppm	09-328-2	09-328-7
1000 µmhos	0.001 megaohms	650 ppm	09-328-3	09-328-8
1413 µmhos	0.0071 megaohms	933 ppm	09-328-11	09-328-12
10,000 µmhos	0.0001 megaohms	6500 ppm	09-328-4	09-328-9
100,000 µmhos	0.00001 megaohms	65,000 ppm	09-328-5	09-328-10

For a complete selection of electrodes and accessories, please refer to the Fisher 98/99 Catalog, or contact your Fisher Scientific sales representative.

To place an order, call 1-800/766-7000
For technical support, call 1-800/943-2006